IN INDUSTRY ○ IN TRANSPORTATION • ON THE SEA • IN THE AIR

DIESEL PROGRESS

DECEMBER, 1938 CIRCULATION OF THIS ISSUE — IN EXCESS OF 14,000 COPIES 25c

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A LUBRICATION SPECIALIST—*backed by the greatest Diesel experience in the oil industry—recommended by thousands of Diesel owners and operators!* Wouldn't you like to have a man like that working for you?

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Socony-Vacuum's "Correct Lubrication" puts the most complete and practical Engineering Service in the oil industry at your disposal. Trained men work for you...help your men solve your special lubrication problems; help you get the most for your lubrication dollar!

And, in addition, "Correct Lubrication" brings you clean, tough, heat-resisting oils... products of 38 years of refining for Diesels!

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STANDARD OIL OF NEW YORK DIVISION · WHITE STAR DIVISION · LUBRITE DIVISION · MAGNOLIA PETROLEUM COMPANY
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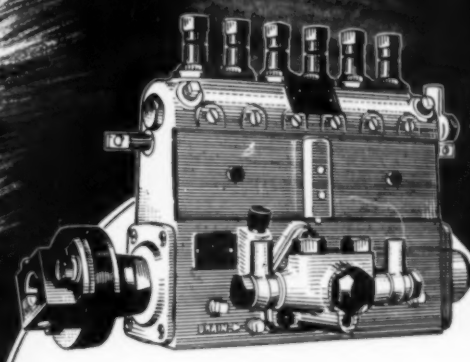
Heir Apparent OR *Guinea Pig?*



THE engine builder who uses American Bosch Fuel Injection Equipment insures his engine against the experimental or little tried. He becomes heir to the oldest and richest fuel injection experience in America . . . heir to time-tested standards of materials and workmanship . . . heir to nation-wide, world-wide service facilities. This rich inheritance is yours only at Fuel Injection Headquarters—AMERICAN BOSCH Corporation, Springfield, Mass.

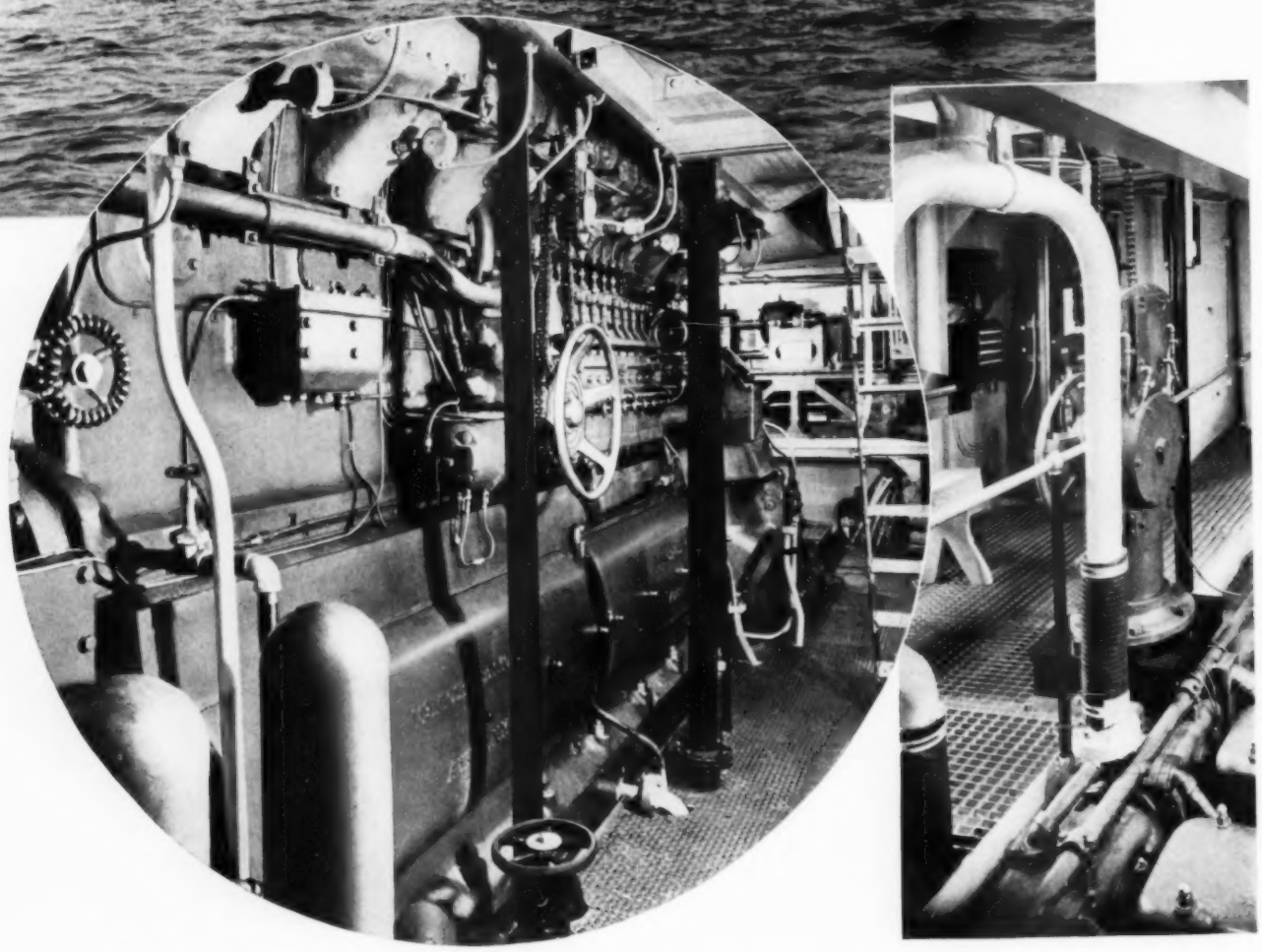
AMERICAN BOSCH

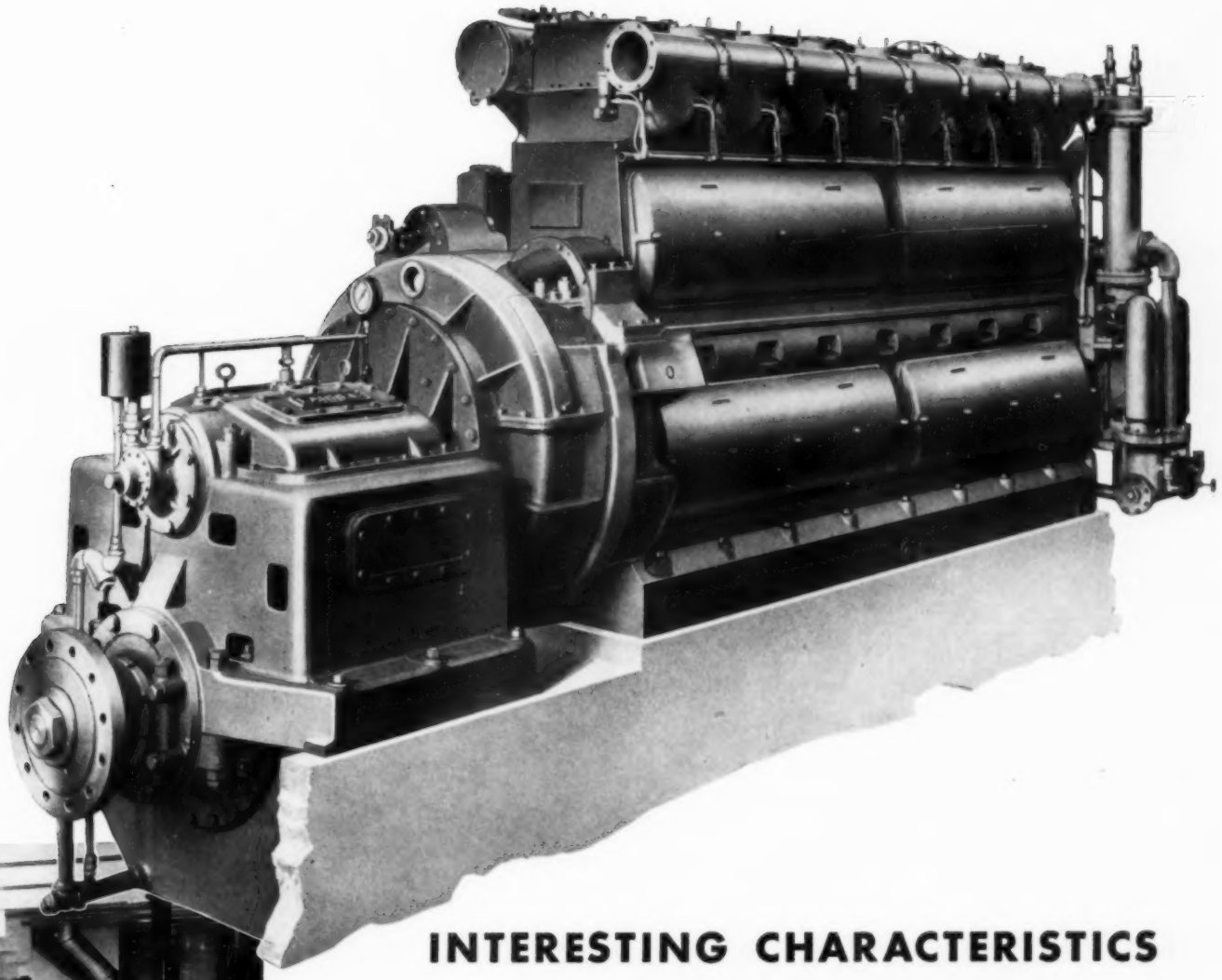
Fuel Injection Equipment

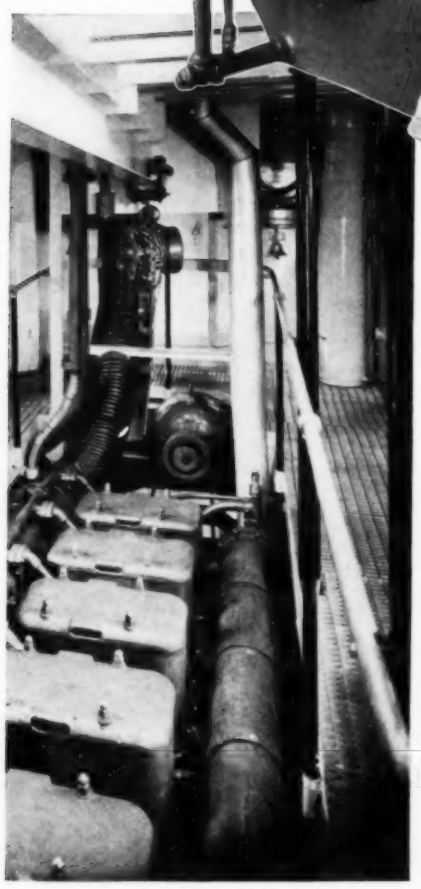
STANDARD OF AMERICA

WORLD WIDE SERVICE

The "OTCO" powered by ALCO UNIVERSAL ENGINE







INTERESTING CHARACTERISTICS ALCO UNIVERSAL ENGINE

Light compact construction consistent with reliability in service and low maintenance cost • • • Tremendously strong backbone made up of a deep girder frame containing upper and lower crankcase and lubricating oil pump cast enbloc • • • An unusually large hollow bored crankshaft • • • Valve gear individual with each cylinder in easily removable compact assembly • • • Entire engine enclosed and oiled under pressure • • • Quantity production and universal application guarantees advanced engineering and service • • •

Alco DIESEL ENGINE DIVISION

AMERICAN LOCOMOTIVE COMPANY
30 CHURCH STREET, NEW YORK CITY

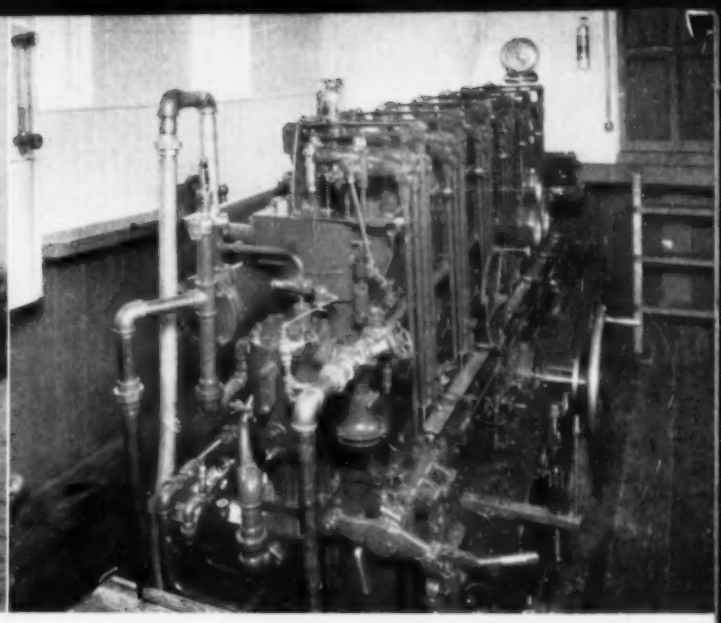
WOODWARD GOVERNORS for DIESELS

System frequency is maintained by the Woodward type IC governor on this new Busch-Sulzer engine at McMinnville, Oregon.

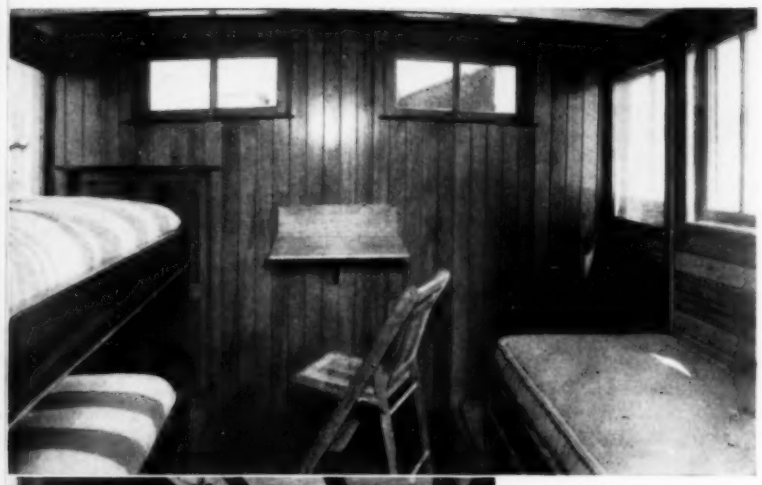
WOODWARD GOVERNOR CO.

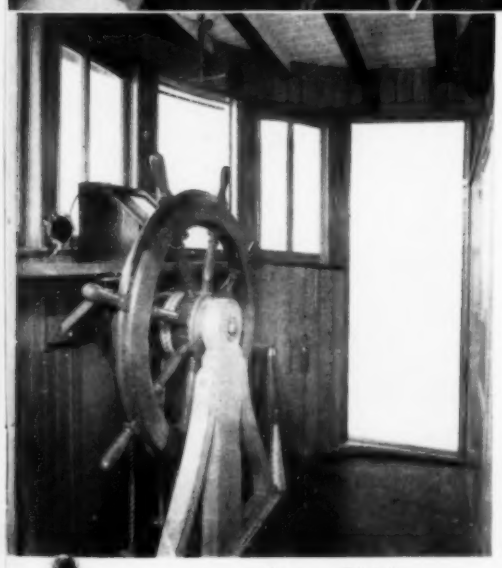
WORLD'S OLDEST AND LARGEST EXCLUSIVE MANUFACTURERS OF HYDRAULIC GOVERNORS FOR PRIME MOVERS

ROCKFORD, ILLINOIS



Atlas Diesel Chosen to Power New Tug "Normahal"





The cabin aft the Wheel House.

Wheel House of "Normahal".

IN the Intercoastal Canal traffic between New Orleans and Houston, Texas, the new 58′ x 15½′ x 6′ tug, "Normahal", built by Arthur Duvic's Sons for Mason Hall of New Orleans, is proving up to her owner's expectations of operating efficiency. A large contributing factor to the economical and efficient operation of the "Normahal" is her 6-cylinder, 9″ x 12″, 160 h.p., direct reversible Atlas Marine Diesel engine, which swings a 56″ diameter, 34″ pitch, three blade Columbian bronze propeller.

Towing heavily laden barges through Gulf waters, under any conditions, calls for plenty of power. Slow-speed, heavy duty Atlas Diesel engines have demonstrated their ability to deliver continuous, dependable and economical power for every need of tug boat operations. After years of service with practically no expense for maintenance or overhaul, Atlas Diesel engines are still good for many more years of profitable operation.

When you need an engine to do a "man-sized" job, an Atlas Diesel will deliver as you expect it to. Atlas Marine Diesel engines come in a wide range of sizes from 30 to 525 h.p. Atlas sales representatives will gladly help you choose the proper engine for your power needs.

ATLAS IMPERIAL DIESEL ENGINE COMPANY

Eastern Division
115 BROAD STREET, NEW YORK, N. Y.

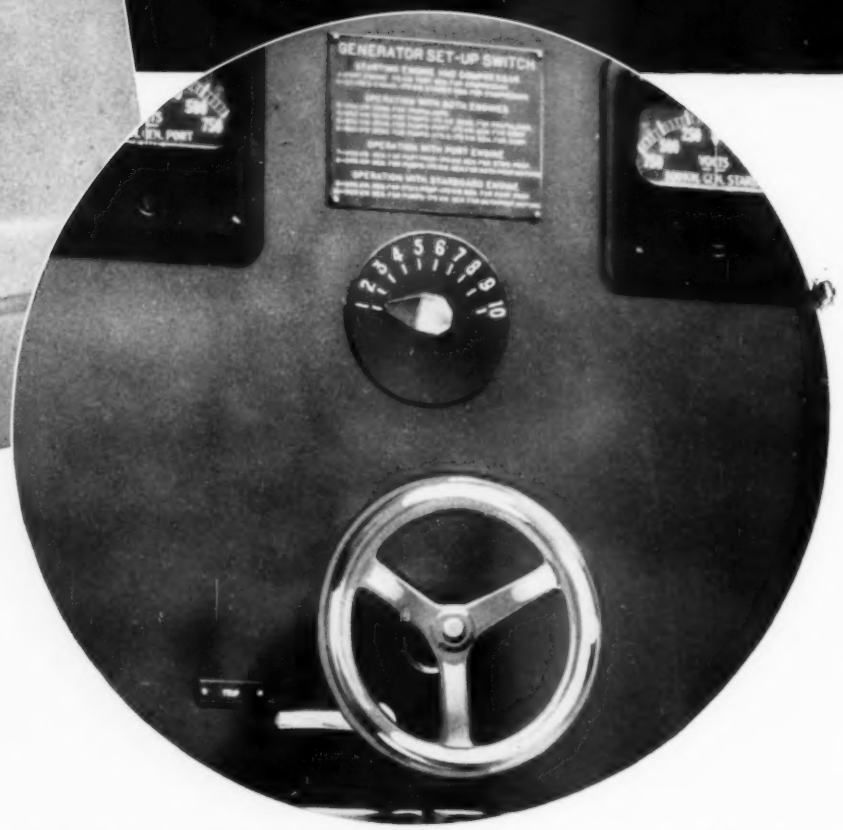
Central Division
228 NO. LASALLE ST., CHICAGO, ILLINOIS

Western Division
1000 NINETEENTH AVENUE, OAKLAND, CALIFORNIA

Gloucester — Baltimore — Charleston — Miami — Jacksonville — Tarpon Springs — New Orleans — Fort Worth
Houston — El Paso — Terminal Island — Seattle — Portland — Vancouver — Ketchikan — Honolulu — Manila

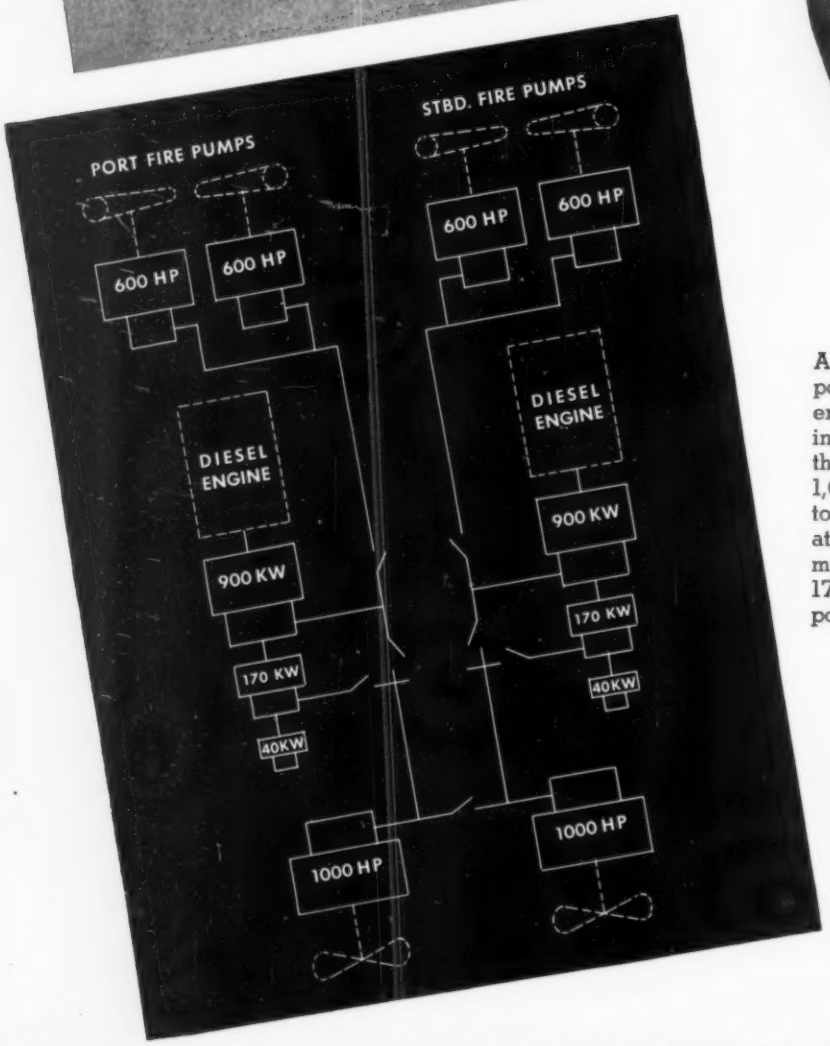
ATLAS IMPERIAL

FINGER TIP C

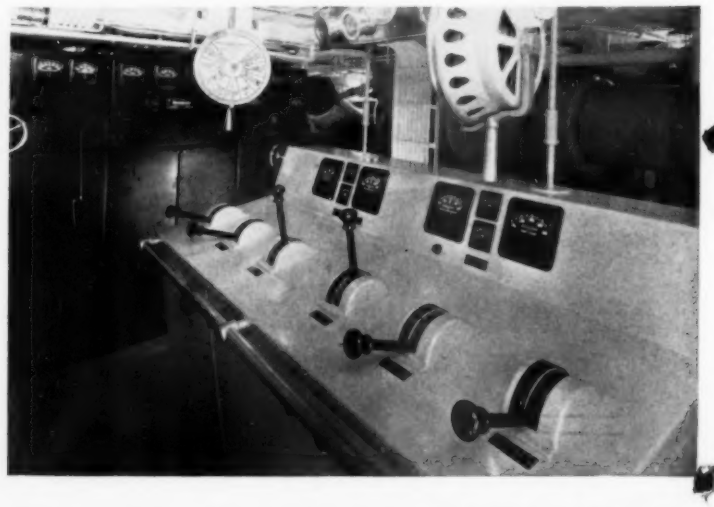


A simple turn of the wheel directs power from the Westinghouse generator sets to propulsion or pumping motors. For propulsion only, the 900 kw. generators drive two 1,000 hp. motors, directly connected to the shafts. These same generators drive four 600 hp. fire pump motors while at the fire, with the 170 kw. generators furnishing power for maneuvering. Two 40 kw. generators are used for excitation and auxiliary power.

Complete safety is provided by protective, interlocking devices to prevent accidental misapplication of power to propellers, pumps, or auxiliary equipment. Power applications can be changed in less than five seconds—thus providing quick flexibility under all conditions—truly "finger tip" control.



Above diagram shows arrangement and main circuit connections of machinery. Solid lines indicate Westinghouse complete responsibility "from prime mover to propeller."



Engine room control desk, for control of pumps, engine speed, and propulsion motors. Maneuvering of the boat may also be controlled from the pilot house. J-93918

Westinghouse

WESTINGHOUSE ELECTRIC

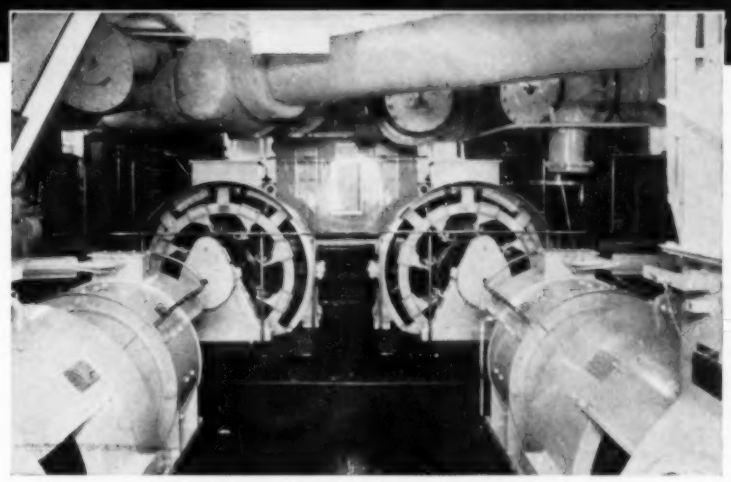
P CONTROL on New "Fire Fighter"

"Nerve center" in one 10" wheel affords complete flexibility of propulsion and pumping power on New York's new "FIRE FIGHTER"

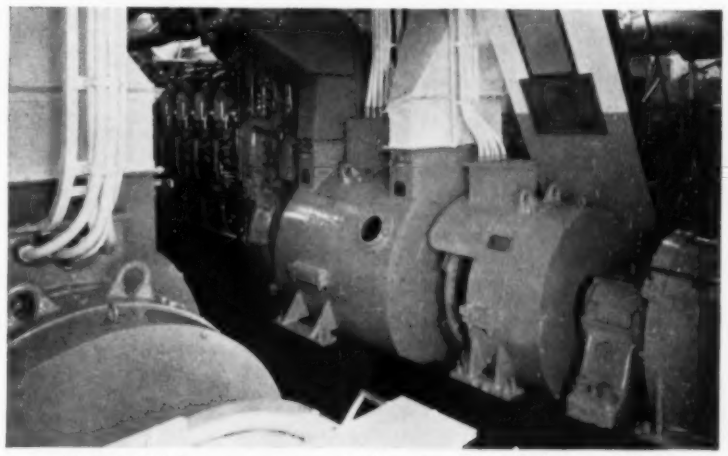
Complete control of power distribution for propulsion and pumping is concentrated in this engine room "nerve center," on New York City's new "FIRE FIGHTER." Twin power plants, each consisting of three Diesel driven Westinghouse generators, can instantly be applied as needed to the Westinghouse motors operating pumps and propellers. Complete flexibility of speed, pumping power, and general maneuverability is afforded at all times — whether the vessel is being rushed to the fire, or is shifting position while fighting it.

While this application of the Westinghouse "nerve center" to the "FIRE FIGHTER" was developed especially by Westinghouse, in collaboration with Gibbs and Cox, the control fundamentally is the same as that used on all Westinghouse marine Diesel power installations. The complete Westinghouse installation of controls, generators, motors, switchboards, etc., is an outstanding example of the co-ordinated service which Westinghouse offers for any type of vessel.

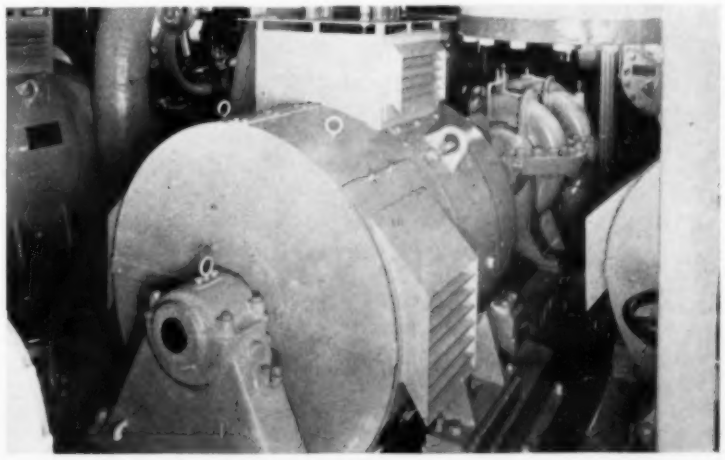
Westinghouse marine engineers are standing by for your call for assistance on marine steam or electrical applications. See the nearest Westinghouse marine representative — or write Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. Address Dept. 7N.



Two Westinghouse motors, each rated 1000 hp., 425 rpm. are used for driving propellers, with exciters and main switchboards in background.



Above: Main generator set, showing Diesel driven Westinghouse generators rated 900 kw., 170 kw. and 40 kw. capacity. Below: Four main fire pumps, with a total capacity of 20,000 g. p. m., are each driven by a 600 hp. 1500 rpm. Westinghouse motor.



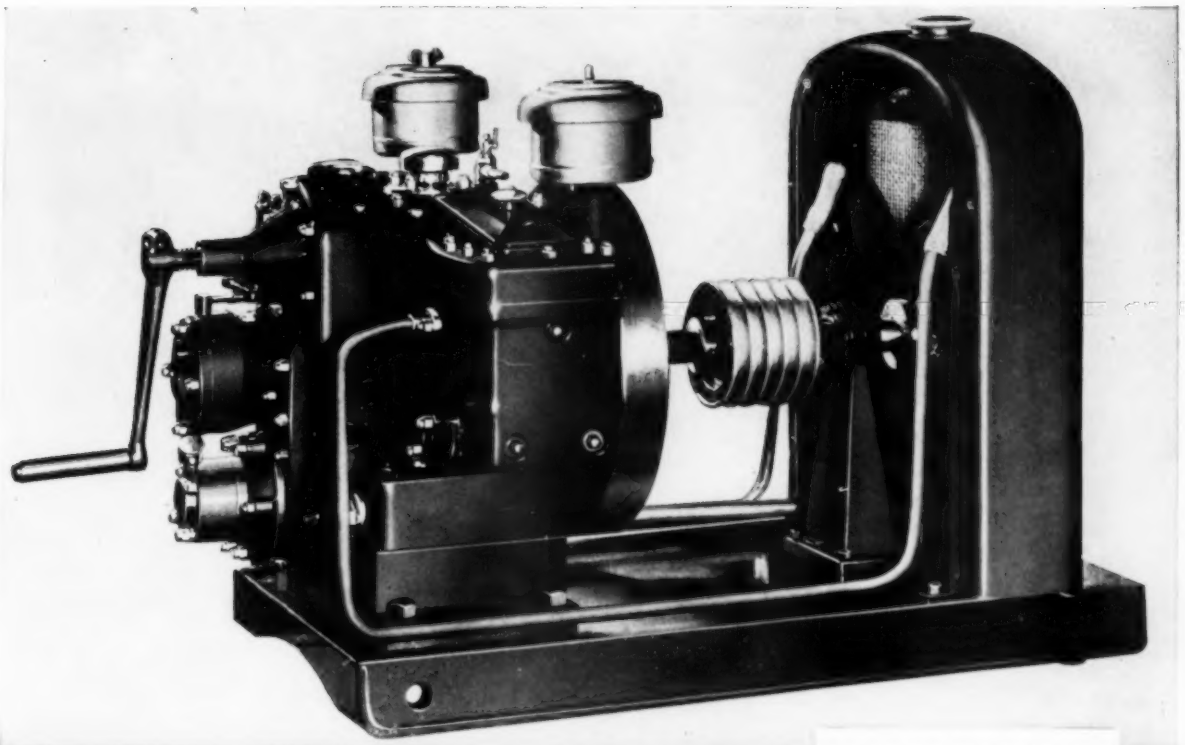
OTHER WESTINGHOUSE MARINE EQUIPMENT

- Auxiliary Turbo-generator sets
- Electric drives for deck and underdeck auxiliaries
- Speed reducers and gearmotors
- Geared turbines
- Turbine-electric
- Switchboards and panelboards
- Circulating and exhaust fans, stateroom fans and heaters
- Micarta tail shaft bearings, pintle bushings, piston rings, and paneling
- Refrigerating and air conditioning equipment
- Lighting

Marine service facilities in every principal U. S. port

Builder of Marine Equipment
Partner in Marine Engineering Progress

DIESEL PROGRESS for December, 1938. Volume IV, No. 12. DIESEL PROGRESS is published monthly by Diesel Engines, Inc., 2 West Forty-fifth Street, New York, N. Y. Rex W. Wadman, President. Acceptance under the Act of June 5, 1934, at Brooklyn, New York, authorized May 14, 1935. Subscription rates: United States and Possessions $3.00, Canada and all other countries $5.00 per year. Single copy price 25 cents in U. S. A., 50 cents for all other countries.



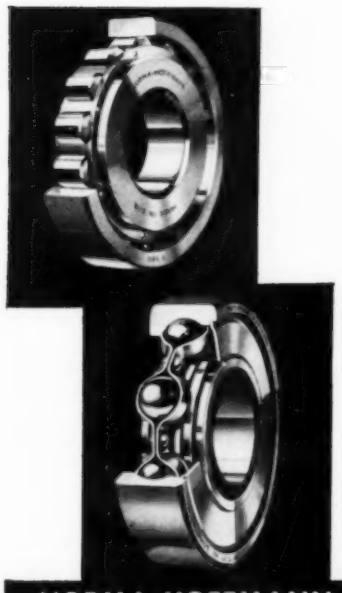
"NORMA-HOFFMANN"

PRECISION BEARINGS

A COVIC DIESEL Power Pack, Type T-2-P—a typical unit in a series of eight, designed for marine and industrial service—all equipped with NORMA-HOFFMANN PRECISION BEARINGS.

Chosen as Standard Equipment in

COVIC DIESEL ENGINES



Dependability, compactness and light weight are the distinctive characteristics of COVIC DIESEL ENGINES featured by the builders—Covic Diesel Division of the Northill Co., Inc., Los Angeles, Cal. * * * * The engineers of the Northill Company chose NORMA-HOFFMANN PRECISION BEARINGS because—within the fixed minimum limits of space and weight—they met their requirements as to PRECISION, load capacity, reliability and long life. * * * * The Covic crankshaft, operating at 1800 RPM, employs heavy-duty PRECISION ROLLER BEARINGS for radial load and shielded PRECISION BALL BEARINGS for endwise location.

In the NORMA-HOFFMANN line of 108 series and over 3000 sizes, there is a PRECISION BEARING for every Diesel engine requirement. Let our engineers work with yours. Write for the Catalog.

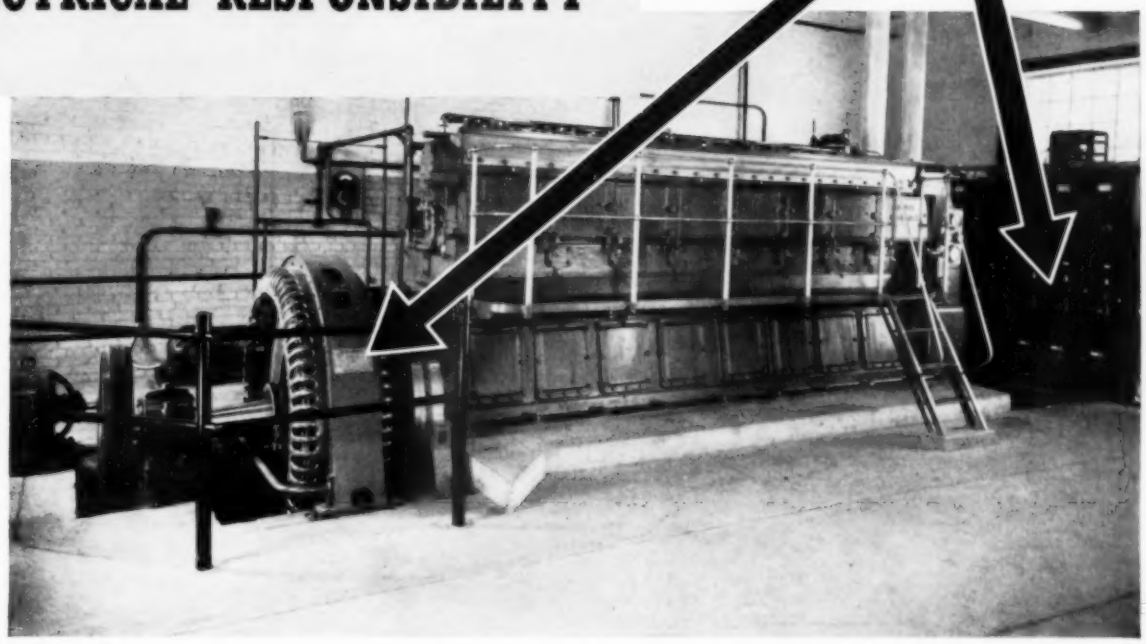
NORMA-HOFFMANN BEARINGS CORPORATION, STAMFORD, CONN., U. S. A.

STANDARD OIL COMPANY (INDIANA)

LUBRICATION ENGINEERING *THE RIGHT LUBRICANT • PROPERLY APPLIED TO REDUCE COSTS*

UNDIVIDED
ELECTRICAL RESPONSIBILITY

Westinghouse



YOU'LL get better results from your Diesel-Electric plant if you place the responsibility for its perfect operation on one, dependable manufacturer. Make it Westinghouse throughout; generator, switching apparatus, voltage regulators, exciters, motors and control for auxiliary equipment.

Westinghouse A.C. Generators are matched to the Diesel engines driving them. Similarly, the other equipment should be designed to operate as matched units, to assure long life and high efficiency. Westinghouse has the engineering and manufacturing facilities to assume such complete responsibility.

Nationwide service facilities are concentrated in 37 Westinghouse service shops. No matter what your need, factory-trained experts are always available to give you prompt and efficient service. This is another advantage of undivided responsibility on electrical equipment.

The booklet, "A.C. Generators for Diesel Engine Drive," gives detailed data on Westinghouse Generators and auxiliary equipment. Write for a free copy.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, EAST PITTSBURGH, PENNA.

J 10073

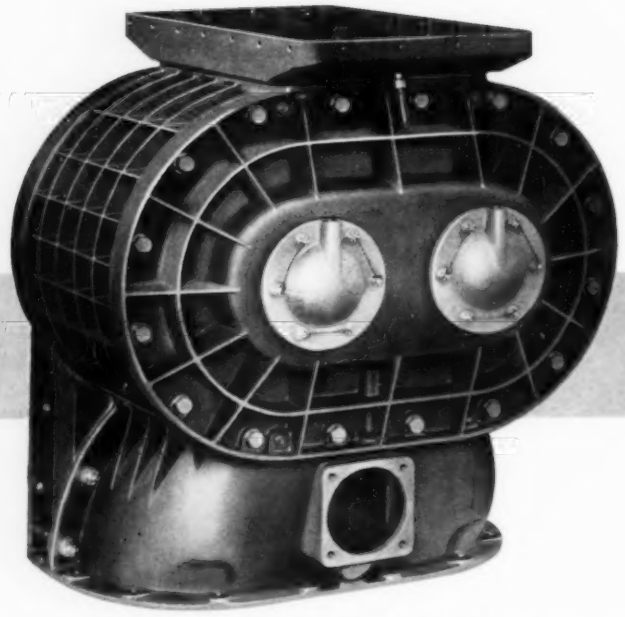
W WESTINGHOUSE ELECTRIC

Westinghouse A·C·GENERATORS *for Diesel Engine Drive*

SWITCHGEAR · VOLTAGE REGULATORS · EXCITERS · AUXILIARY MOTORS · AUTOMATIC CONTROL

Here's why we say,

"ALUMINUM GIVES YOU ADDED EFFICIENCY"



The blower, made largely of Aluminum, adds little to the engine's weight—much to its horsepower.

As a Weight Saver

There's no more economical way of saving weight in the Diesel engine than through the use of Alcoa Aluminum Alloys. Aluminum frames, bedplates, cylinder blocks, pistons, cylinder heads, blower housings and covers make possible weight savings as high as 60%. Your engine delivers more horsepower per pound of weight because of Aluminum.

As a Space Saver

By utilizing to full advantage the thermal properties and lightness of Aluminum, the output of an engine can be greatly increased without increasing the overall size of the engine. This added horsepower is obtained at low cost. Aluminum cylinder heads, pistons, blowers and crankpin bearing boxes all contribute to high specific output.

This increased output is obtained without sacrifice to sound engineering practices, so essential for reliability. Aluminum Company of America, 2141 Gulf Building, Pittsburgh, Pennsylvania.

ALCOA · ALUMINUM

VARIABLE ENGINE SPEED
—a new measure of Economy

Now introduced into Diesel-Electric Drive installations by the GM Diesel

TO the long list of operating efficiencies the GM Diesel contributes to the Diesel-Electric Drive—marine operators can now add another.

It's a variable engine speed that means new fuel economy and even lower maintenance cost.

No longer must the engine be run at constant speed, as is customary in this type of drive. In the new General Motors Diesel-Electric Drive installations, power plants now operate at half speed until the propellers reach half speed. Only at the higher propeller speeds need the engines turn up their full R.P.M.

Thus can workboats make another important saving in all service requiring less than full load engine output.

A similar improvement in operating efficiency also results, since all major mechanisms are considerably simplified. Likewise, its adaptability is greatly extended—even to vessels whose layout arrangements once made Diesel installations seemingly unsuitable—by providing the required horsepower in whatever arrangement of units and accessories best fits the space available.

Today, the GM Diesel offers every craft in the heavy marine field an opportunity to enjoy the operating advantages and safety of a Diesel-Electric Drive. And under the General Motors all-inclusive policy of manufacture, installation and service, repairs and servicing are handled so that a ship's idle time is kept to an absolute minimum.

For All Marine Uses

GENERAL MOTORS DIESELS

★ Single units—15 to 1200 horsepower ★ Multiple units—any required capacity

W GM DIESEL POWER

FORMERLY WINTON

GENERAL MOTORS

Sales Corporation

DIESEL ENGINE DIVISION • Cleveland, Ohio

All America . . . the nation-wide proving ground of the

CUMMINS DIESEL

supplies the ***Job-Test*** **for your protection**

CUMMINS DIESEL OWNERS WERE *first* WITH 1,000,000

DEMONSTRATING THAT THE CUMMINS DIESEL WAS PRACTICAL

A CUMMINS DIESEL OWNER WAS *first* WITH 13,891,451

DEMONSTRATING THE DEPENDABILITY AND LOW MAINTEN

A CUMMINS DIESEL OWNER WAS *first* WITH 49,000,000

DEMONSTRATING THE LONG LIFE OF THE CUMMINS DIESEL (FIRST

CUMMINS DIESEL OWNERS WERE *first* WITH 100,000,000

COVERING EVERY LOAD AND ROAD CONDITION, BOTH ON

This is the JOB-TEST EVIDENCE back of the Cummins Diesel you are offered today as a replacement engine for your obsolete power or original equipment in your new truck.

CUMMINS ENGINE COMPANY, 2314 WILSON STREET, COLUMBUS, INDIANA

Evidence

when you buy YOUR diesel!

miles **of diesel-powered truck performance**

CAL AND ECONOMICAL FOR FLEET OPERATION

miles **of diesel-powered truck performance in** ONE FLEET

TEN ANCE OF THE CUMMINS DIESEL

miles **of diesel-powered truck performance in ONE long-haul fleet operation**

RST ENGINE PURCHASED MAY, 1933)

miles **of coast-to-coast diesel-powered truck operation**

ON LONG HAULS AND SHORT

CUMMINS
Dependable
DIESEL
PIONEER IN MODERN DIESEL DEVELOPMENT

These Nationally-Known Trucks are offered with ***CUMMINS*** *dependable* ***DIESELS*** *as original or optional equipment:*

AUTOCAR
AVAILABLE
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FAGEOL
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HENDRICKSON
HUG
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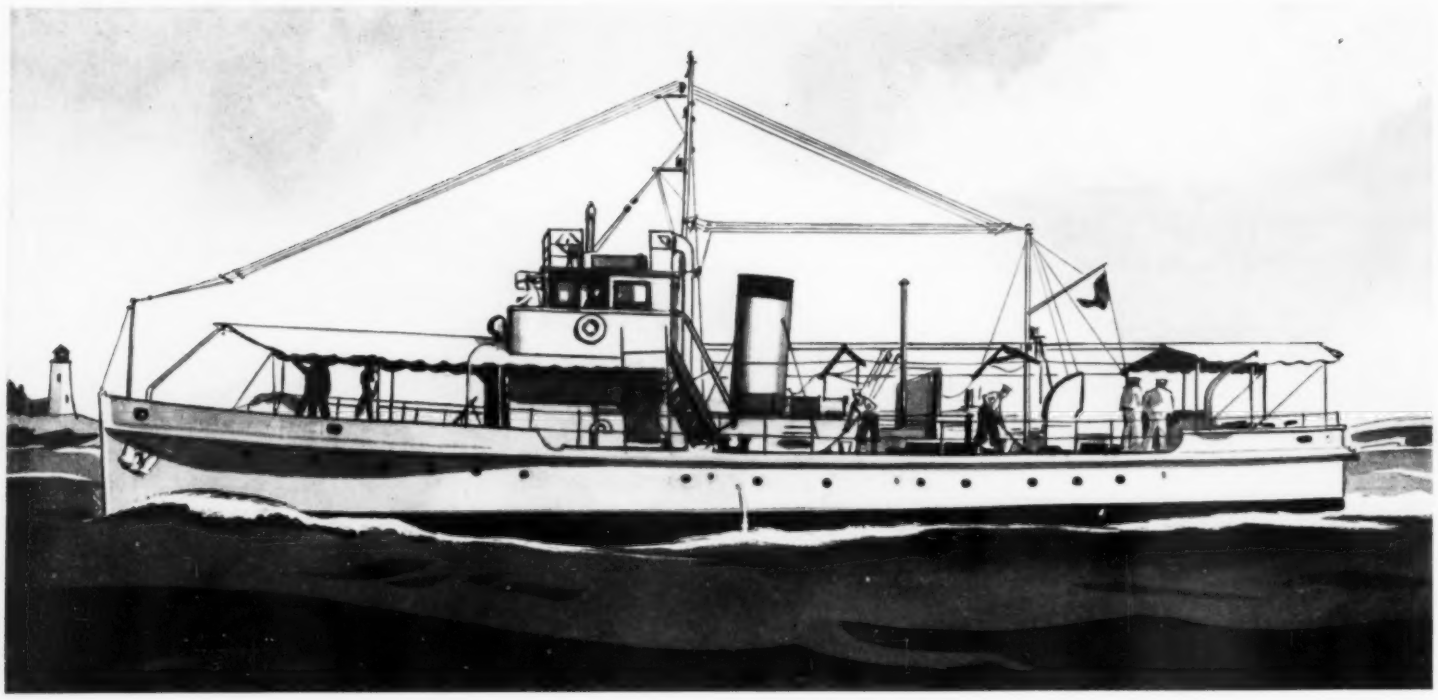
CATERPILLAR

REG. U. S. PAT. OFF.

JOINS THE NAVY!



In their acceptance by the U. S. Navy, there is evidence enough of the advantages being offered by the new "Caterpillar" Diesel Marine Engines.

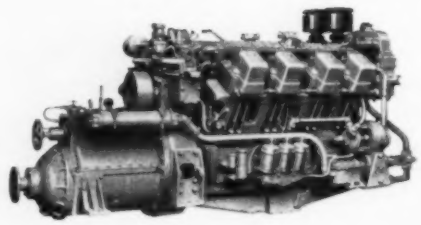
The name "Caterpillar" long ago established itself as standing for dependable, economical power. That it can do the same afloat has already been shown in the few short months since this marine package became available!

Here is a complete, compact unit . . . easily installed . . . sturdy in construction . . . simple in design . . . economical with fuel . . . low in upkeep . . . and rated for continuous duty (24 hours a day, 365 days a year).

Regardless of where a ship may sail, it will find "Caterpillar" Diesel Service in practically any one of the world's ports!

See your nearest "Caterpillar" dealer, or write us direct for more information.

CATERPILLAR TRACTOR CO.
PEORIA, ILLINOIS



THE "CATERPILLAR" DIESEL MARINE ENGINE IS AVAILABLE IN THREE SIZES

8 cylinder—
5¾" x 8"—900 R.P.M.—
135 BHP Continuous Duty

6 cylinder—
5¾" x 8"—900 R.P.M.—
100 BHP Continuous Duty

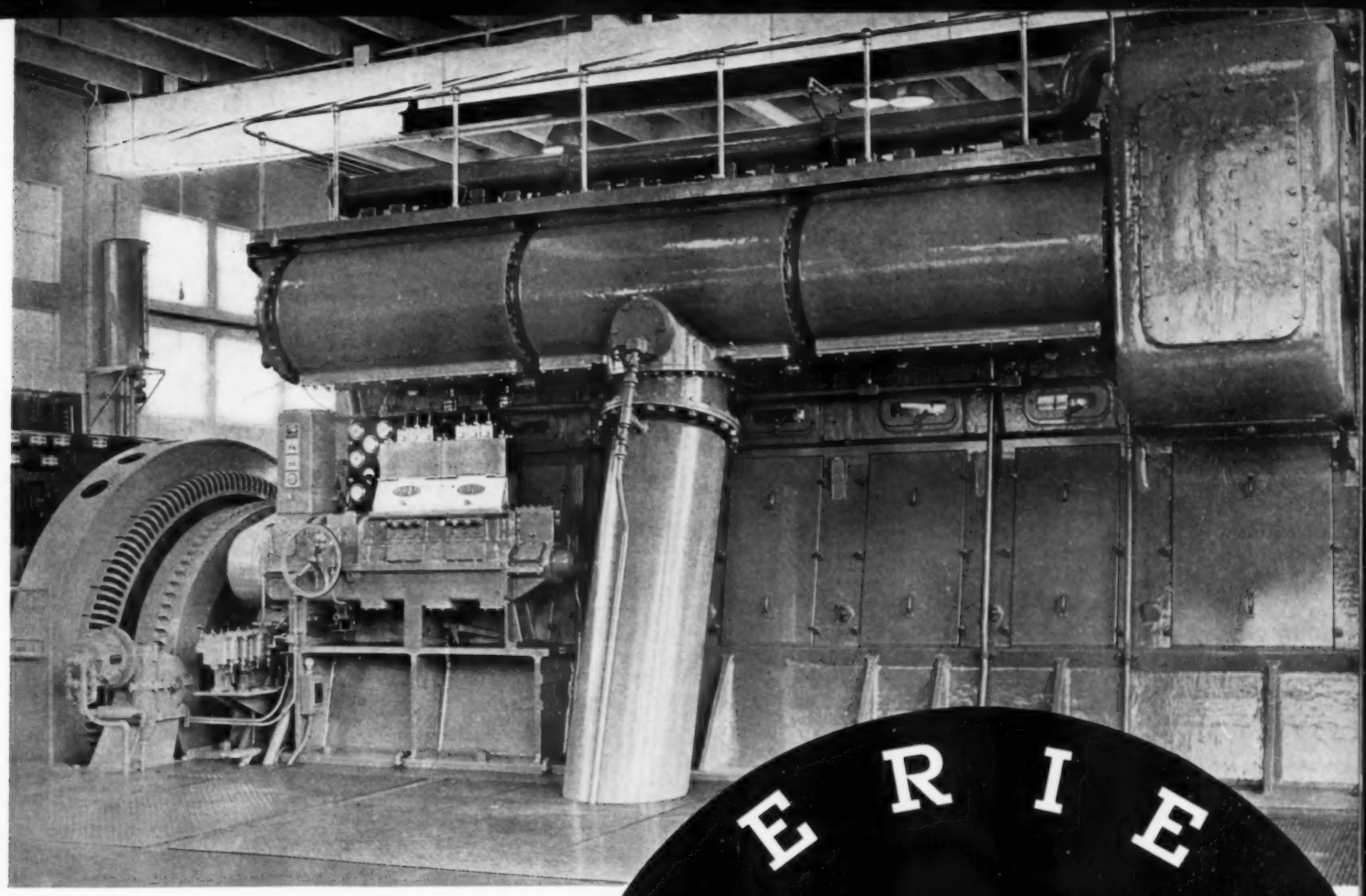
6 cylinder—
5¼" x 8"—900 R.P.M.—
80 BHP Continuous Duty

CATERPILLAR DIESEL POWER

REG. U.S. PAT. OFF.

DIESEL ENGINES • DIESEL-ELECTRIC GENERATOR SETS

See the "Caterpillar" Diesel Marine Engine at the New York Motor Boat Show, January 6-14, 1939



ERIE

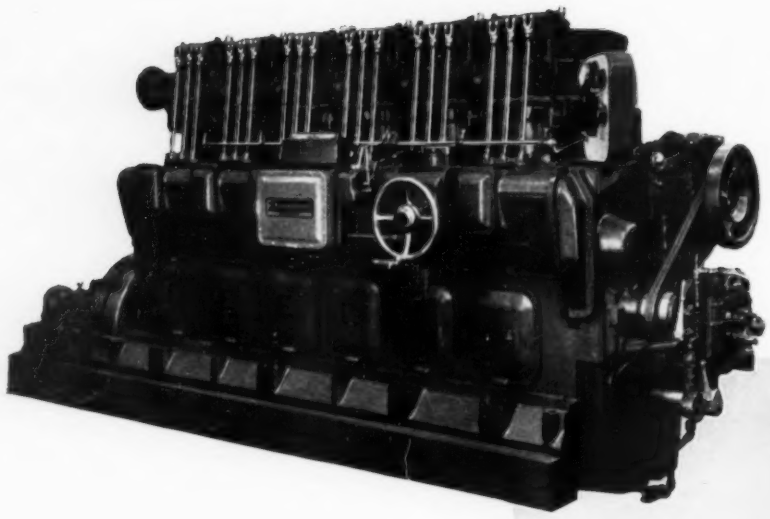
POWER

This 1800 hp. Diesel recently built by Busch-Sulzer Bros. Diesel Engine Co. and installed in the McMinnville, Oregon, Municipal Diesel Plant is equipped with an Erie crankshaft.

The crankshaft in any installation must be of fine quality and be accurately machined to give smooth performance. That's why all leading Diesel engine builders specify Erie crankshafts.

Rough and finished connecting rods, piston rods, crossheads, generator and extension shafts for all Diesel engines. Prompt delivery on all major forged or cast steel elements required in every type of construction.

ERIE FORGE CO., ERIE, PENNSYLVANIA



DAUNTLESS
POWERED BY
ENTERPRISE

600 Horsepower
Direct Connected
Direct Reversible

Outstanding performance of the 600 Hp. Enterprise Diesel engine in DAUNTLESS No. 12, owned by the Dauntless Towing Line, Inc., establishes a new standard for tug boat operation. Designed for this service, and built on modern, simple and rugged lines, these engines provide, through the four-cycle principle, the most economical form of dependable propulsion.

Enterprise Diesel engines are built in four, six, eight, and ten cylinders with capacities from 100 to 1500 Hp. They are furnished for straight, direct drive, or with gear or electric drive where slow propeller speed or lighter weight is important. Ask for copies of our new catalogs.

NEW YORK OFFICE—50 Church Street.

General Offices:
2904 Nineteenth St.
SAN FRANCISCO

ENTERPRISE ENGINE COMPANY

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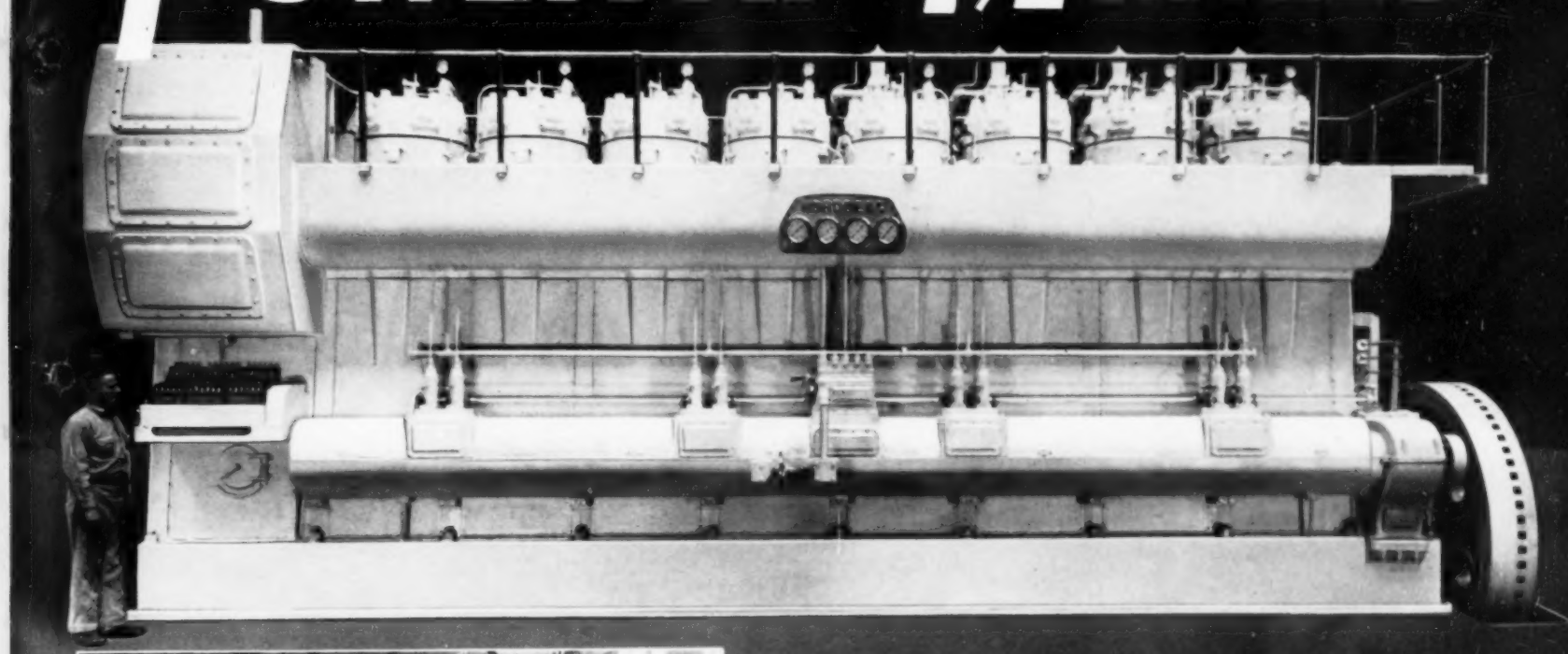
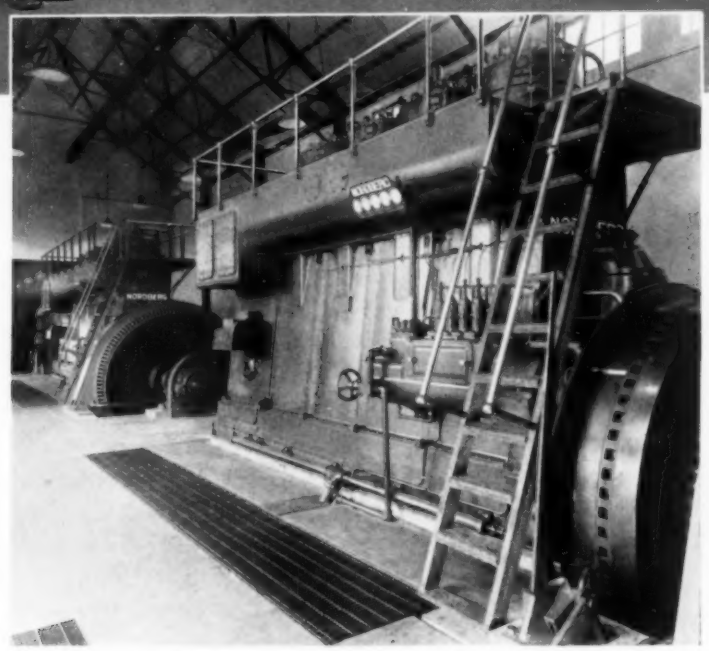
LOS ANGELES and
SAN FRANCISCO

POWER AT 4½ MILLS





At the top is shown the new eight cylinder, 2000 horsepower unit. Below is the original installation of 1000 and 1450 horsepower engines.

Nordberg's extensive line of two and four cycle engines in a wide range of sizes permits the selection of a proper type and size for any service.

The municipal power plant at Greenville, Texas, has established a record for producing low cost power with Diesel engines in this country. The operating report for 1937 shows that the two Nordberg Diesels, installed in 1933, generated 6,720,110 K.W. at a cost of 4½ mills per K.W. hour. Included in this cost are the items of labor, fuel and lubricating oils, maintenance, supplies and incidentals. In addition to the efficient operation of Nordberg Diesels, low maintenance was also a factor contributing to this low cost production. For the year, maintenance for the two engines was only $621.58. This unusual performance is even more significant when consideration is given to the unfavorable load factor of but 40 per cent.

After five years of faithful service with Nordberg Diesels at Greenville, when the need arose for additional generating capacity last year, another Nordberg engine, one of 2000 horsepower, was installed and which is now in service. This is just one more instance of a satisfied user continuing to purchase Nordberg Diesels on the basis of past performance.

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NORDBERG DIESELS

★ ★ ★

★ ★ ★

Experience with 3 Superior Diesel Powered Tugboats Satisfies Rohl-Connolly Co.

The Rohl-Connolly Company is a well known general contractor handling big construction jobs of all kinds on the Pacific Coast.

After experience with three Superior Marine Diesels, they now specify Superiors for generating sets and portable power units.

The reason can be stated in three simple words: "THE PERFORMANCE SATISFIES!"

Superior DIESELS

HEAVY DUTY MODELS: 50 to 810 H. P., 250 to 720 R. P. M.

HIGH SPEED MODELS: 15 to 230 H. P., 900 to 1800 R. P. M.

THE NATIONAL SUPPLY COMPANY . . . SUPERIOR ENGINE DIVISION

FACTORIES: Springfield, Ohio; Philadelphia, Pa. • SALES OFFICES: Springfield, Ohio; Philadelphia, Pa.; New York, N. Y.; Los Angeles, Calif.; Houston, Texas.

TIMKEN Fuel Injection Equipment Minimizes Servicing Delays and Expense

Replacing a pumping unit in a TIMKEN Fuel Injection Pump.

Previous practice in the servicing of fuel injection equipment in the field became obsolete when renewable pumping units such as used in the TIMKEN Fuel Injection Pump were developed.

Prior to this revolutionary improvement, the engine operator had to call the nearest service station—which might have been one or one hundred miles away—for help when the fuel injection equipment ceased to function. This usually resulted in the return of the pump to the manufacturer for repair.

When TIMKEN Fuel Injection Equipment is used the service station is seldom required. The operator can do his own emergency servicing in the field. There is ordinarily no need to remove the pump from the engine. Thus, long delays and considerable expense are avoided. TIMKEN Fuel Injection Equipment has taken all the mystery out of fuel injection with a greatly simplified system that any truck or tractor driver or garage mechanic can understand and service when necessary.

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It will pay you to apply TIMKEN Fuel Injection Equipment to your present fuel oil burning engines and to specify it when buying new ones. Write for further information.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

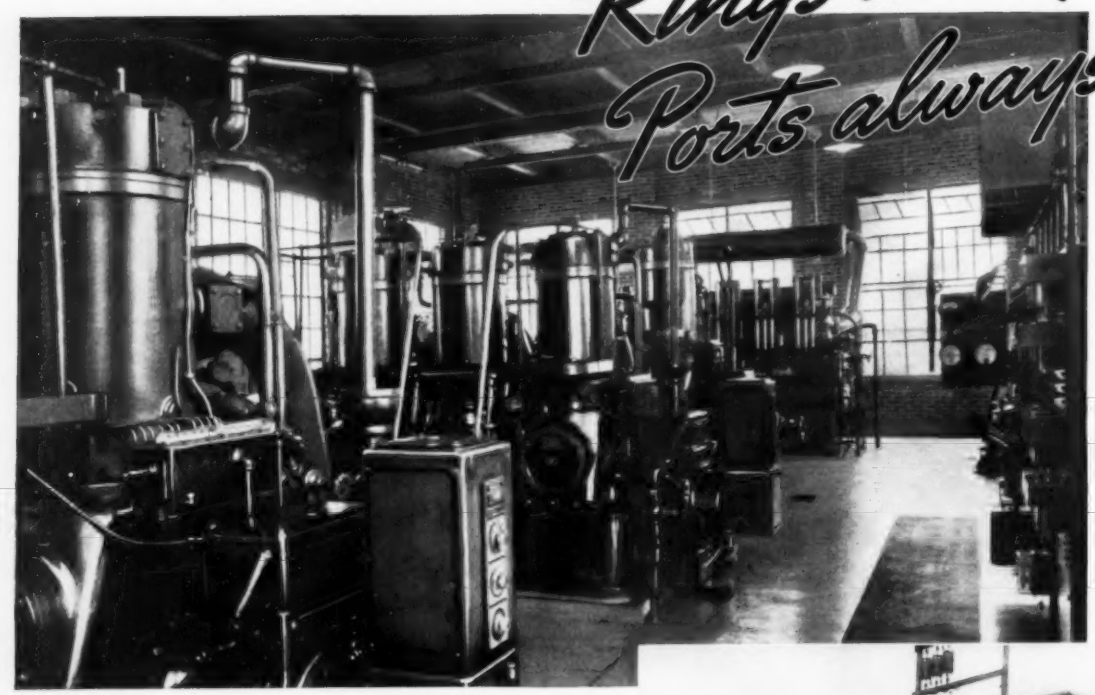
Manufacturers of TIMKEN Tapered Roller Bearings for automobiles, motor trucks, railroad cars and locomotives and all kinds of industrial machinery; TIMKEN Alloy Steels and Carbon and Alloy Seamless Tubing; TIMKEN Rock Bits; and TIMKEN Fuel Injection Equipment.

TIMKEN

FUEL INJECTION EQUIPMENT

FOR 7 YEARS

Rings always Free! Ports always Clear!



General view of Diesel plant in Hatfield, Pa. This plant has been 100% Texaco lubricated since 1931. Yearly inspections show rings free, exhaust ports clear, wear minimum.

Three Fairbanks-Morse Diesels in foreground. Two are 3-cyl., 2-cycle, 165 h.p. model 32. The third is a 2-cyl., 2-cycle, 120 h.p. model Y. Worthington 6-cyl., 4-cycle, 300 h.p. Diesel in background.

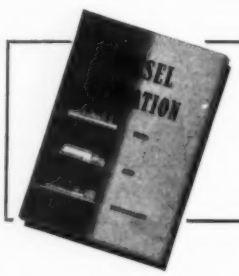
SINCE BUILT IN 1931, the Fairbanks-Morse, and later, Worthington Diesels in this Hatfield, Pa. plant have been lubricated 100% with Texaco Ursa Oil.

Year after year, they pull the pistons for annual inspection, only to find piston rings free in their grooves, exhaust ports clear. What little carbon found is soft and fluffy.

Wear is reported at a minimum . . . all this *after 7 years* with Texaco Ursa Oil.

For higher lubricating efficiency in *your* plant, get in touch with Texaco. Trained lubrication engineers offer their help in selecting and applying the right lubricants, and prompt deliveries are assured from 2186 warehouses. Write or phone the nearest one, or:

The Texas Company, 135 East 42nd Street, New York City.



DIESEL OPERATION *is the title of Texaco's 80-page treatise. Every Diesel operator should have a copy among his plant books. Yours for the asking.*

TEXACO

URSA OIL FOR DIESELS

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DIESEL PROGRESS

REX W. WADMAN
Editor and Publisher

FRONT COVER ILLUSTRATION: The Mack Diesel-powered tractor, as exhibited at the National Motor Truck Show, powered with a 6-cylinder Mack-Lanova Diesel engine.

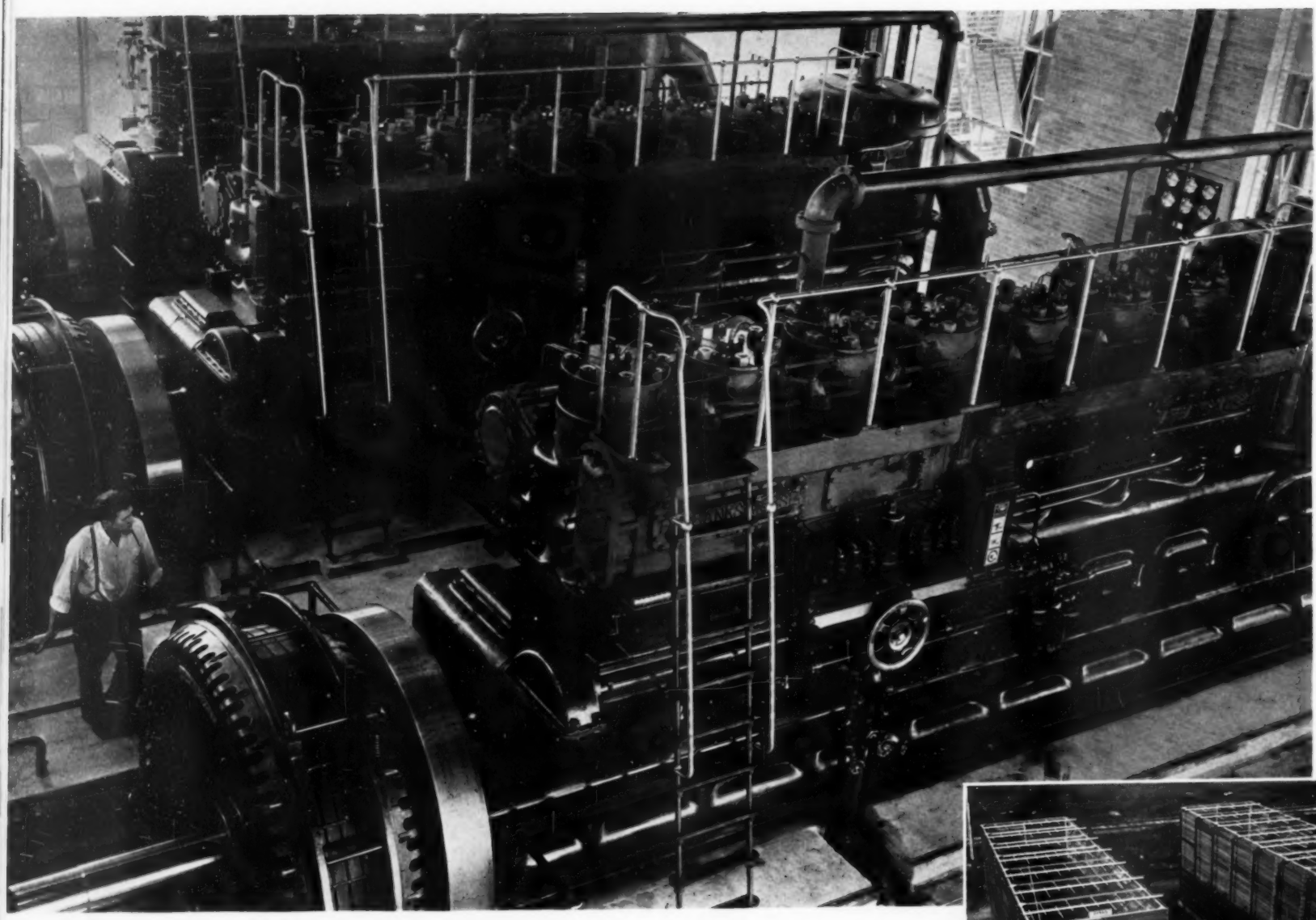
TABLE OF CONTENTS ILLUSTRATION: Caterpillar Diesel tractor pulling a 5 ft. cover crop disk, working in wine grapes and prune orchard in Alexander Valley, California. Working ten hours a day on 1½ gal. of 7c fuel per hour, covering 1¾ acres per hour.

DIESEL PROGRESS for December, 1938, Vol. IV, No. 12. Published monthly by Diesel Engines, Inc., 2 West 45th St., New York, N. Y. Tel. MUrray Hill 2-5092. Subscription rates: U.S.A. and Possessions $3.00 per year; 25c per copy. All other countries, $5.00 per year; 50c per copy.

B. J. VON BONGART
Technical Editor

CCA

CONTENTS • DECEMBER



The three Fairbanks-Morse Diesels installed at Ubly. Note Woodward governor and Nugent fuel oil filters.

The two Binks cooling towers installed to the left of the main power plant.

UBLY, MICHIGAN

A Very Successful R.E.A. Project

By I. A. BOSMAN

Assistant Chief Engineer, Southern Michigan Engineering Corp., Lansing, Michigan

THE Thumb Electric Cooperative was organized early in 1937 under the sponsorship of the Rural Electrification Administration and Ubly was selected for its headquarters in the heart of the Thumb district. The Southern Michigan Engineering Corporation of Lansing, Mich., were the engineers on this project.

Three-quarters of a mile north of Ubly, on State Highway No. 19, is the generating plant, one side of which is bordered by the Pere Marquette Railroad, providing an ideal fuel oil

unloading facility. Fuel oil can also be unloaded from tank trucks into the three 30,000-gal. above-ground storage tanks. A fuel transfer pump located in the basement transfers the fuel oil from the storage tanks to the day tanks and at the same time meters the amount used. Each engine has its own day tank holding 500 gal. of fuel and should a batch of dirty fuel oil be received, it may be by-passed through a Gould Hydroil unit to a 5,000-gal. clean oil tank, adjacent to the fuel oil storage tanks.

The plant generates and supplies approximately 1,300 miles of distribution line which will ultimately service some 5,500 customers. There is also 57 miles of 33 kv. transmission line and this serves the lower half of the project through two step-down sub-stations.

Concrete and steel-faced with brick, the generating plant is 78 ft. long by 67 ft. wide. The total cost of the plant is approximately $300,000, which is repayable over a period of twenty years at 2.88 per cent per annum. Fan type heaters, supplied from the jacket water, furnish heat for most of the plant. The small rooms, however, are equipped with radiators, similarly connected to the jacket water system.

The present generating capacity of the plant is 2,102 kw. and provisions have been made for an additional 1,000 kw., giving an ultimate of 3,102 kw. when needed. There are two 1,050 hp. and one 900 hp. Fairbanks-Morse 2-cycle Diesel engines turning at 257 rpm. These are direct-connected to two Fairbanks-Morse 3-phase, 60-cycle, 2,400 v., 920 kva. generators and one 787 kva. generator. The exciters are also Fairbanks-Morse, 15 kw. 125 v. driven by Allis Chalmers Tex-Rope V-belts at 1,450 rpm.

The engines are equipped with Woodward governors and Alnor pyrometers, Maxim DO4 silencers taking care of the exhausts. American air filters supply the engines with filtered air, and there are two Binks cooling towers used to cool the raw water, each of which is capable of taking care of two engines. A heat exchanger, connected to a header on the raw and soft water sides, is attached to each engine and with this arrangement any pump can be used for any machine, thereby making the cooling system very flexible. The water supply is taken from a deep well and pumped into a 1,500-gal. storage tank located in the basement from which all of the water needed in the operation of the plant is taken. Jacket water is run through a water softener before it is used in the system. The cooling tower makeup, however, is taken directly from the tank without softening.

An Ames purifier, having a capacity of 52 gal. per hour, cleans and purifies the lubrication oil whenever necessary and there are three lubricating oil tanks in the basement: one for storage, one for dirty oil, and one for clean oil.

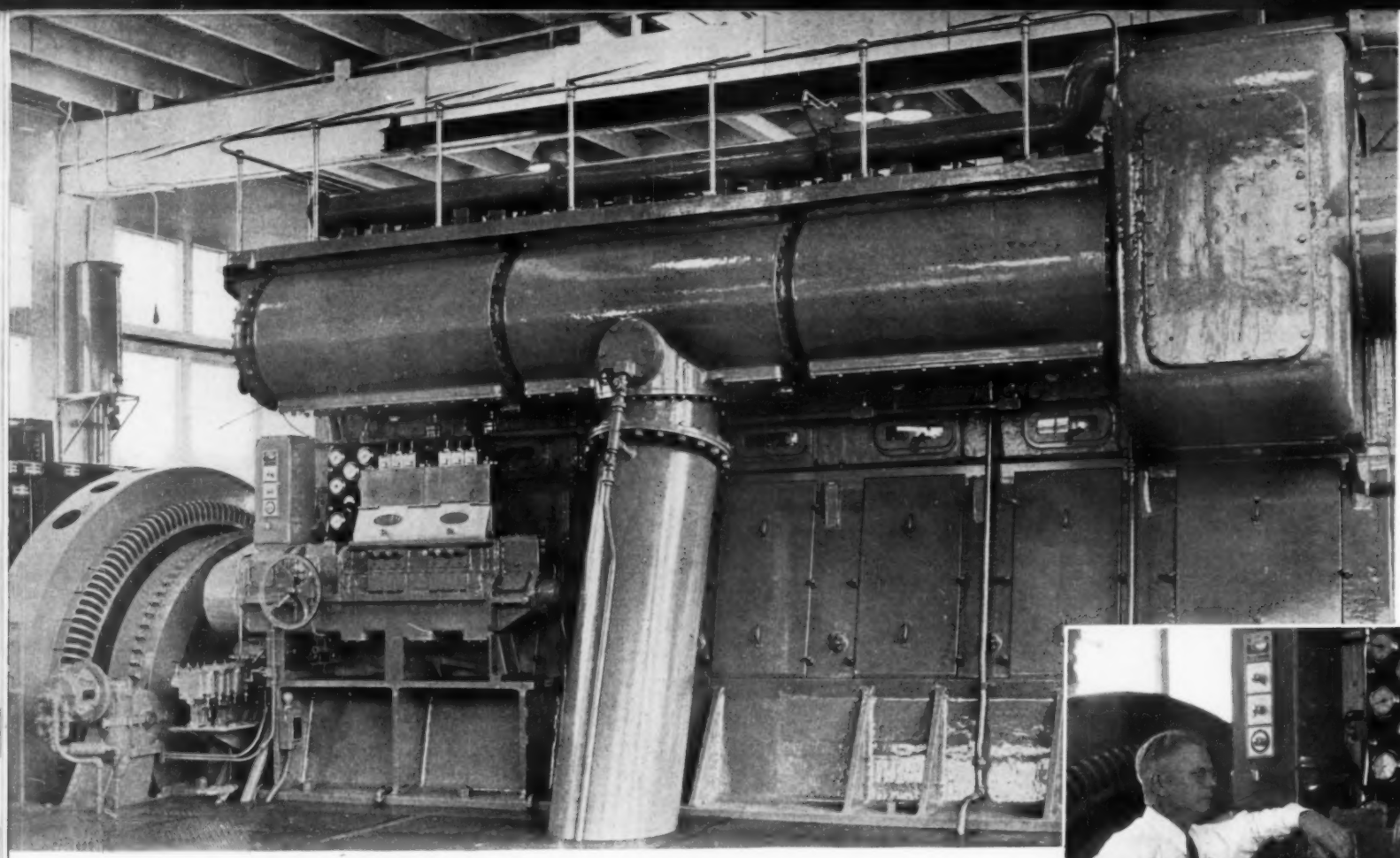
The switchboard, consisting of nine panels, was built by the Allis-Chalmers Manufacturing Company. There are three generator control panels with one spare for a future unit: One panel takes care of the voltage regulators, also made by Allis-Chalmers, and the other two are feeder panels controlling the 33 kv. circuit and two 12.5 kv. circuits. One panel of this board is used for graphic and totalizing instruments and the blank panel will be used in the future for a feeder. The 33 kv. circuit is protected by relays for overload and a ground relay, which operates when a flashover occurs on the transmission line, protecting it from burning down the conductor.

The station power transformer bank consists of three 37½ kva. Allis-Chalmers air-cooled type, 2,400 v. by 120/240 v. The sub-station is equipped with four 333 kva. 2,400/33 kv. step-up transformers, one of which is a spare. The 12.5 kv. bank consists of four 250 kva. transformers which step up from 2,400 v. to 7.2/12.5 kv. The two 12.5 kv. circuits are each controlled by a Pacific breaker, operating from the switchboard.

Editor's Note: — This Rural Electrification Administration Project is typical in many respects. In recent issues of Diesel Progress several R.E.A. projects have been described in considerable detail. In all cases excellent engineering has characterized both the layout and the equipment of the plants and full credit is due to the Administration officials in Washington and to the Consulting Engineers on the individual jobs for the broad-gauge manner in which these Diesel generating plants have been projected, built, and put on the line.

This Thumb Electric Cooperative is located in a section of Upper Michigan where electric service has been very difficult to obtain. Now the whole area surrounding Ubly has electric service available at a very low rate and ample provision has been made to add additional generating capacity as the load develops — as it inevitably will.

Exterior of the Thumb Electric Cooperative's Diesel generating plant at Ubly, Michigan. Maxim silencers show on the roof.



The new 1,800 hp. Busch-Sulzer 2 cycle Diesel recently installed in the McMinnville, Oregon, Municipal Diesel Power Plant, bringing the total installed capacity up to 3,900 hp.

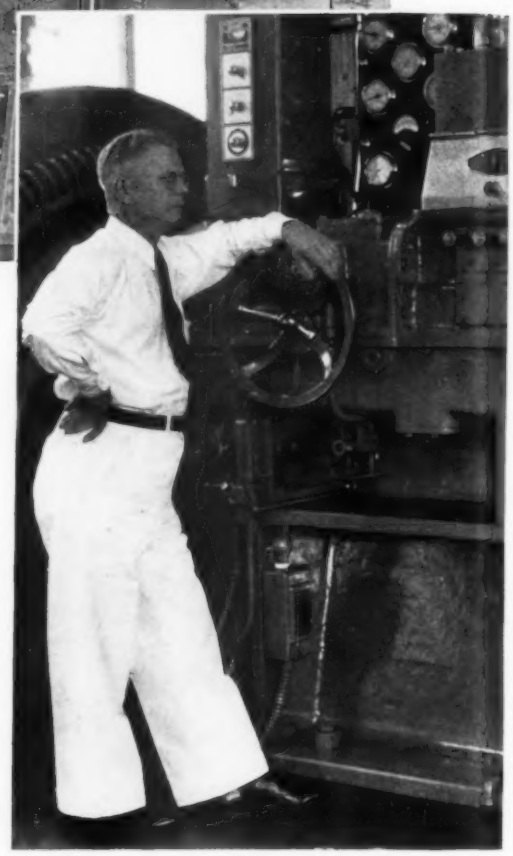
A NEW ENGINE FOR McMINNVILLE, ORE.

By CHARLES F. A. MANN

WHEN viewed from afar, the City of McMinnville's Municipal power system is more than a highly successful publicly owned power plant: it is one of the unique and outstanding successes in the whole of the U. S. A.

Primary reason is the fact that about 100 miles northeast the United States Government is completing the $55,000,000 Bonneville project. Yet, in spite of Federal Kilowatts, Volts and loose talk of cheaper electricity, the astute Municipal Water and Light Commission of McMinnville decided late in 1937 that this hustling little city of McMinnville could actually increase its already successful Diesel power plant by some 1,800 hp. and actually beat the delivered price of "cheap" Bonneville Power!

With its first beginnings back in 1889, seven years after the electric light was practical, McMinnville was one of the very first publicly owned electric power plants in the United States. It was the very first in the Pacific Northwest. Originally, a funny old steam plant on the Yamhill River, then a small hydro and steam combination on the city's waterworks system, and later a Diesel station in the heart of the city. The Oregon Legislature passed a special act in 1905 to permit it to be run as a publicly owned utility, yet to function as a private business. Some fourteen years ago two 300 hp. 6 cylinder Diesels were installed. In 1926 the first Busch-Sulzer Diesel was put in — a 600 hp. 6 cylinder, 4 cycle, air injection model. In 1931 an 8 cylinder, crosshead, 2 cycle, air injection Busch-Sulzer Diesel was put in to keep pace with the rapidly growing demand for electricity. The 1931 installation created wide and favorable comment, and it gave the city another 1,500 hp. of cheap Diesel power.



Chief Engineer, F. J. Reynolds, standing at the controls of the new 1,800 hp. Busch-Sulzer. Notice Woodward governor, which is used for both frequency and speed control, and the Alnor pyrometer on the instrument board.

With each new unit the rates dropped, until now, in 1938, rates get down to 8 mills per kilowatt hour for larger users. The modern home electric gadgets, such as water heaters, cost only $2.75 per month on a flat rate.

Since 1920 M. H. McGuire has been the indefatigable Manager of the McMinnville Light and Water system, now a $750,000 institution. His tact, precision, genial per-

sonality, and steadfast purpose in creating one of the most efficient power plants in the country, have made him a figure in the municipal power industry in the Northwest. His record as a Diesel station operator is so good, that even skeptical old Jim Murphy, Marine Supt. of the famed Puget Sound Navigation Company, largest Diesel ferryboat operators in the U. S. A. comes down to spoof with McGuire and swap notes on how to prune costs and get the cost of fuel oil down! The reason for mixing up the No. 1 Northwest marine Diesel operator with the No. 1 Northwest Diesel electric station operator, at this point, is because McGuire has operated Busch-Sulzers for the past 12 years and Mr. Murphy has two giant, 2 cycle Busch-Sulzers in his famed *Kalakala* and *Chippewa*, exactly like the new 6 cylinder, 2 cycle, solid injection Busch-Sulzer that McMinnville proudly put into operation when Governor Martin, the explosive anti-New Dealer, flipped the wheel October 22nd ot this year.

The new McMinnville Busch-Sulzer is an exact counterpart of the *Kalakala* and *Chippewa* Diesels in every respect except that it has only 6 cylinders, instead of 10 and 8 respectively.

There are two distinguishing features on the McMinnville installation that make it outstanding: First, is the fuel heating system, and second, is the cooling system.

Probably the McMinnville fuel heating system evolved by Mr. McGuire and Mr. Otradov of the Busch-Sulzer installation staff will be widely copied throughout the world. The reason is that it seems to offer a practical answer on the question of how to make a 240 rpm. 2 cycle Diesel function successfully at all times, and under all load conditions, on heavy, black boiler fuel costing about $1.20 per barrel instead of refined Diesel fuel at $2.50 or more per barrel.

For McMinnville, immediately after the new 1,800 hp. unit was cut in, preparations at once began on the job of providing the big 1,500 hp. and the smaller 600 hp. units with a fuel heating system to burn black oil, instead of the light fuel now used. This means re-piping the entire powerhouse, installation of centrifuges, heaters, pumps, and valves. The 1,500 hp. job, after grinding away for seven years, is to be given a thorough overhauling and changeover on the new fuel system.

The heating system begins with the use of cooling water, which, after heating in the engine jackets, goes to a large concrete vault built underground. In this vault lies the 20,000 gallon main fuel tank. Resting in a bath of warm water at all times, the black fuel is kept at a temperature of around 100° F. from the time supplies are added, until withdrawn as needed. The two older engines at present are using city water from the mains. The installation of a closed circuit cooling system will likewise help to increase overall efficiency in the older engines by reason of higher inlet water temperatures and less chilling of the lower cylinder walls.

From the main storage tank the fuel is pumped into water jacketed pipelines, with water flowing in a closed special circuit direct from the exhaust pipe manifold. The inner pipe has a water jacket entirely around it, welded tight and connected to the water heating system.

Thus, the necessary heat required for warming the fuel oil is obtained practically without current expense involved by the use of electric heaters, which would absorb approximately one per cent of the generated kw. output.

The black fuel is raised to about 150° F. before centrifuging in a special Sharples unit. The injection system is the modified Busch-Sulzer Hesselman unit pump design, with injection pressures raised to 6,000 lbs. per square inch. The inlet temperature of the centrifuged black oil is approximately 185° F. at the Hesselman pumps. Special new type injection valves are used. The fuel oil has a viscosity of about 700 S.S.U. at 100° F.

Briefly, the older engines average 10 to 11 kw. per gallon of fuel while the new 1,800 hp. unit will get from 12 to 14 kw. per gallon. In dollars and cents, the McMinnville station expects to save between $750 and $1,000 per month on an annual output of 5½ million kilowatts. The average cost per kilowatt for fuel, lube, labor and supplies, including repairs, has been .0062 and it is expected that the cost per kilowatt will fall to somewhere around 4½ mills, a record hard to beat in any man's language. The Diesel oil now used averages 144,150 B.T.U. per gallon and the heavier black fuel will deliver 147,100 B.T.U. per gallon. The black fuel gives more heat units and costs much less. A 30 per cent saving in fuel costs is indicated for the new McMinnville setup.

The new Busch-Sulzer unit is a 6 cylinder trunk piston, 19½" x 27", 2 cycle solid-injection, exact counterpart of the *Kalakala* and *Chippewa* engines. Scavenging, however, is done with a tandem reciprocating scavenging pump 39½" x 38" bore x 17¾" stroke, driven from the main shaft. A Woodward automatic Governor is fitted, and used for both frequency and speed control together with an Alnor

The McMinnville Municipal Diesel Power Station. The new unit is installed in the right-hand end of the building.

General view of the McMinnville Diesel Power Plant, the new 1,800 hp. unit in the foreground, the 600 hp. unit in the middle, and the 1,500 hp. unit in the background.

Pyrometer set and a chain driven Northern Rotary oil circulating pump for piston cooling. A Sims heat exchanger cools the piston oil. A double unit Bosch lubricator is fitted, with six outlets for each cylinder. Each cylinder has 6 compression rings and a wiper ring above and below the electrically lighted piston chamber. Weight of the new unit is around 100 lbs. per horsepower, as compared with 230 lbs. per horsepower for the 1,500 hp. engine installed in 1931. This marked reduction in weight illustrates graphically the advances made in engineering and design of Busch-Sulzer engines in the past seven years.

There are Motoco individual thermometers on each cylinder water jacket, and American oil thermometers. The main generator is a 1,250 kw. General Electric alternator, generating its maximum output at 240 rpm. It is of 2,300 volts, 3 phase design and has a separate chain driven exciter. A 60 cu. ft. capacity starting air reservoir is fitted, operating at 350 lbs. pressure, and supplied by a 2 cylinder Ingersoll-Rand type 30 air compressor, motor driven. A 2 cylinder Ingersoll-Rand air motor is fitted for turning the Diesel when down for inspection and overhaul. A Sentinel oil filter is fitted.

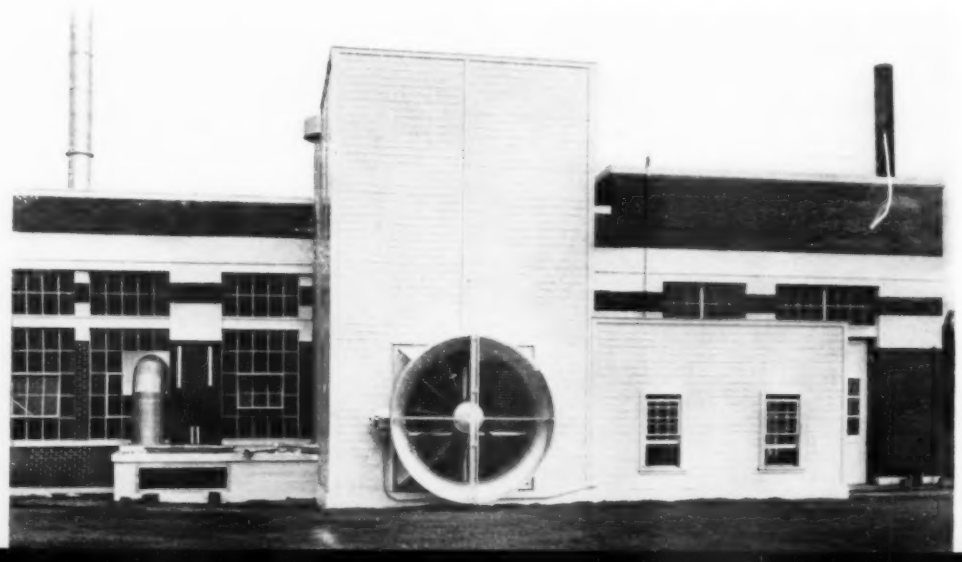
Ken Ayers, the busy Lube engineer for Standard Oil of California, has supplied a rpm. 30 SAE lube oil for bearings and piston cooling, and a rpm. 40 SAE lube oil for cylinder lubrication. Compounds to give it added oiliness and to prevent ring sticking are added to the lube oil.

The cooling system, which at present handles only the 1,800 hp. unit, is of sufficient capacity to care for the entire plant when changeovers are made.

It is built around a Marley patent cooling tower, and has two nozzles. The wooden tower is supplied by a single 12 bladed variable speed and variable pitch propeller fan, with motor and pitch controls thermostatically arranged so as to give practically full automatic operation. The exact water temperature for the return circuit to the engine jackets is constantly maintained at 80° F. by variation of propeller pitch and motor speed. Five Allis-Chalmers motor driven centrifugal water pumps are fitted in a special room at the base of the Cooling Tower to handle water through the closed system. Evaporation loss is about 1 per cent and the tower system is rated as highly efficient.

. . . . *And now please turn to page 63*

Marley cooling tower with variable speed and variable pitch propeller fan.



The latest addition to the Dauntless towing fleet powered by a 600 hp. Enterprise Diesel. The "Dauntless No. 12" is the second Diesel tugboat purchased by this company within two years.

"DAUNTLESS No. 12"

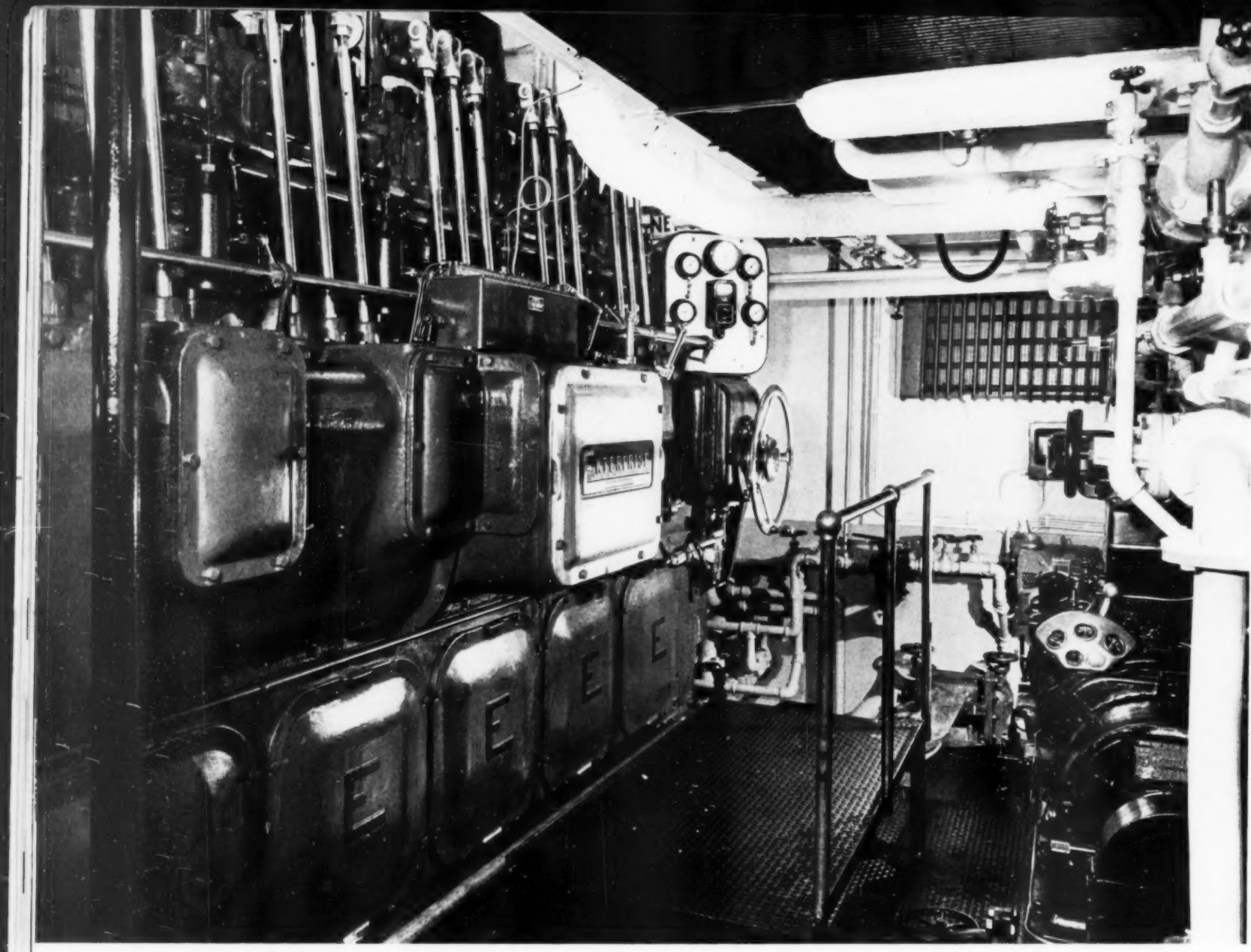
By OTIS A. SIBLEY

"WE bought another Diesel tug — that speaks for itself." This was the reply of Dauntless Towing Company executives to the question, "What has been your experience with marine Diesel engines in towing service?" Considering the number of years this well known organization has been successfully engaged in the towing business and the variety of vessels they have operated, such a statement does speak for itself and it also constitutes an irrefutable testimonial for marine Diesel propulsion.

The *Dauntless No. 12* is the second Diesel tug to fly this familiar burgee in less than two years. She is almost identical in design and construction to the highly successful *Dauntless No. 11* which was fully described by DIESEL PROGRESS in February, 1937, so that only a brief general description will be repeated. The all-welded steel hull, built by Jakobson & Peterson, Inc., of Brooklyn, measures 86 ft. 6 in. by 24 ft. by 8 ft. 8 in., with a gross displacement of 140 tons. As indicated by the illustrations, the spacious pilothouse gives almost 360 degree unobstructed vision, with the captain's quarters located conveniently aft and slightly below on the upper deck. The weather deck enclosure houses the galley forward, directly under the bridge, and two double crew's staterooms both forward and aft of the upper engine room. Compared with the old-time towboats, these accommodations are the last word in comfort and convenience.

The engine room, amidship, carries a 6 cylinder, 600 hp., 4 cycle Enterprise Diesel directly connected to the propeller through a Kingsbury thrust bearing. Its normal rated speed is 260 rpm. Auxiliary power is supplied by a 4 cylinder Superior Diesel which drives a 20 kw. Electro-Dynamic generator mounted on an integral steel sub-base. Other auxiliary equipment includes Maxim spark-arrester silencers, Purolator and Sentinel fuel and lubricating oil filters, a Brown pyrometer and a Smith-Meeker switchboard. Steering is effected by an American Engineering Company electrically driven steering gear. Electric power when under way is supplied from a generator which is V-belt driven from the propeller shaft and from the above mentioned auxiliary Diesel when the main engine is shut down. In a similar way compressed air is obtained from either the main engine mounted compressor or the motor-driven unit, both of which were supplied by Gardner-

Interior view of the pilothouse as seen from the companionway leading to the captain's quarters aft.



View of main engine control panel looking forward from the starboard side. The Superior Diesel auxiliary generating set appears at the extreme right.

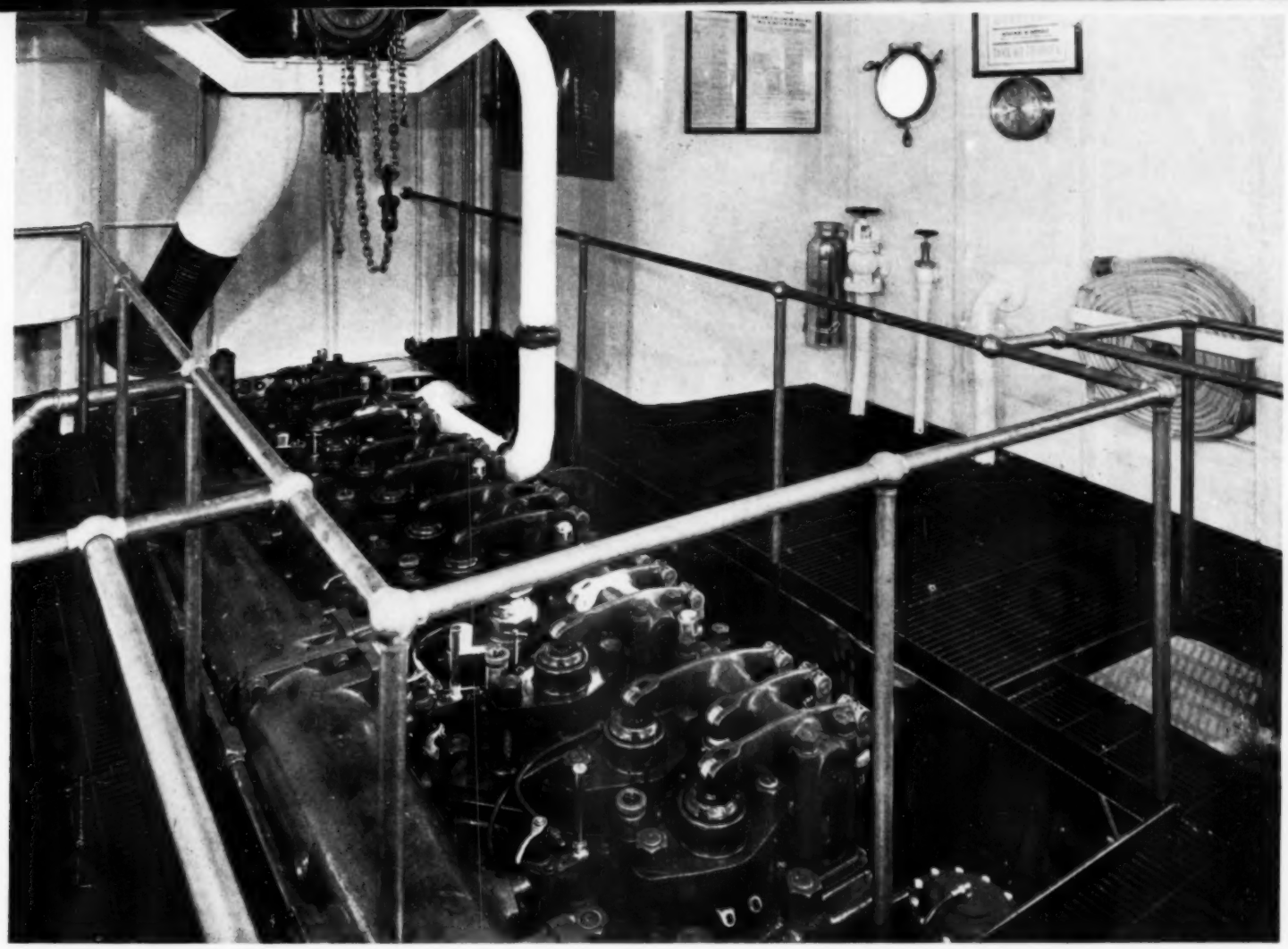
Denver. Edison storage batteries guarantee starting air for main or auxiliary engines at all times through the latter compressor and motor.

The main Diesel also carries as built-in equipment a Harrison lubricating oil cooler, Schutte-Koerting heat exchanger for the closed cooling system and a Manzel lubricator. The reversing mechanism is worthy of particular note. In addition to the usual wheel at the control panel for manual operation the reversing gear is connected to an air motor actuated by a hand lever. The engineer responds to a reversing signal simply by slowing down engine speed, moving this lever until a visual indicator shows that the camshaft has shifted and then adjusting the throttle to the desired position. The speed and dependability of this arrangement was amply demonstrated when the accompanying exterior photographs were made. It was necessary to make a number of short runs in the East River, New York Harbor, to satisfy light conditions for the photographer standing on a pier. A combination of short runs and quick turns with heavy river traffic and an unusually strong wind and tide provided excellent conditions for the vessel to demonstrate her remarkable response to bridge signals, however numerous.

The Enterprise Diesel selected for the main propulsion unit is well known for its heavy duty design and construction. Long steel through-bolts extend from a point near the cylinder head to the cross web in the base adjacent to the main bearing studs and, thus, effectively distribute the firing stress. From the practical operating and maintenance standpoint it is important to note that accessibility has in now way been sacrificed in producing an exceptionally strong and rugged general assembly. In this particular model the valves are seated in the cages, although smaller units carry them directly in the head. In either case special attention has been given to proper cooling through uniform circulation. Fuel is supplied to each cylinder by its individual Bosch pump which permits a minimum of high pressure tubing of equal length in each case to the injection nozzle in the head. Pistons are fitted with American Hammered rings.

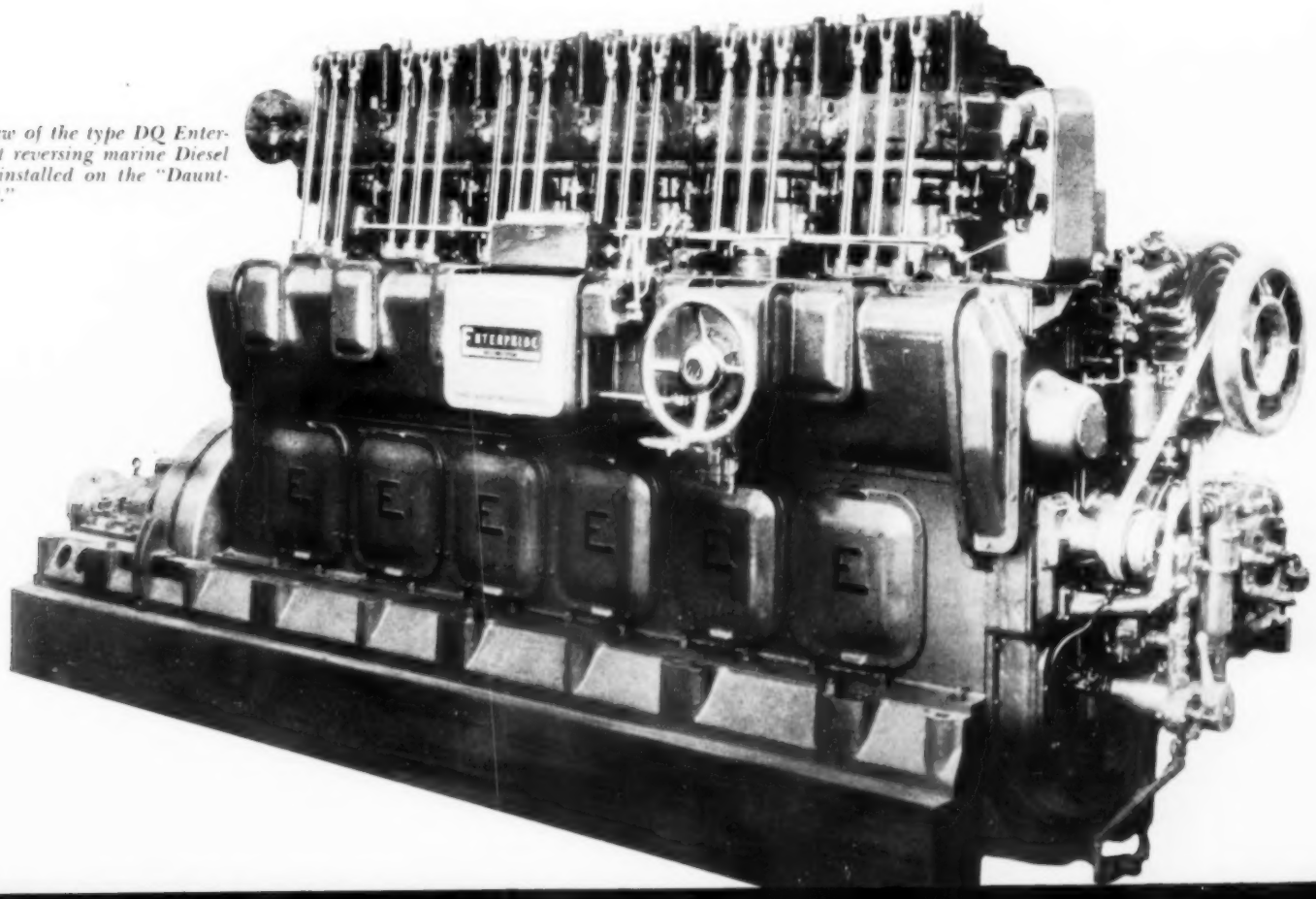
Pressure lubrication is employed with a dry sump. The lubricating oil pump is actually two pumps, one for keeping the crankcase clear and one for supplying line pressure. This one system maintains proper lubrication to all moving parts except the open valve rockers which need very little and the cylinders which are supplied by the mechanical lubricator driven by a ratchet from the camshaft. The entire design has aimed successfully at quiet, dependable operation with minimum attention and maintenance.

With a fuel oil capacity of approximately 300



The grating of the upper engine room makes the top of the Enterprise Diesel easily accessible for inspection and maintenance. A 1½ ton Yale hoist runs parallel with the engine overhead to facilitate periodic overhauling.

barrels it is estimated that the *Dauntless No. 12* can operate for five weeks without refueling which makes her particularly adaptable for long tows or exceptionally busy periods of long duration. For marine work Diesel "availability" is equally important with operating economy. New York Harbor and Long Island Sound will see much of this trim yet powerful tug from now on, since a great part of her service will be in local waters with coastwise trips as required. Her progressive owners have every reason to be proud of their latest investment in dependable and economical Diesel propulsion. They have learned from practical experience that the statement, "We bought another Diesel tug—" means also, "We are prepared to give better service to our customers and on a more profitable basis."



Factory view of the type DQ Enterprise direct reversing marine Diesel engine as installed on the "Dauntless No. 12."

DIESEL

One of the 6,000 hp. Diesel electric locomotives recently delivered to the Seaboard Railway and a reproduction of a full page advertisement which appeared in the "New York Times" on November 6.

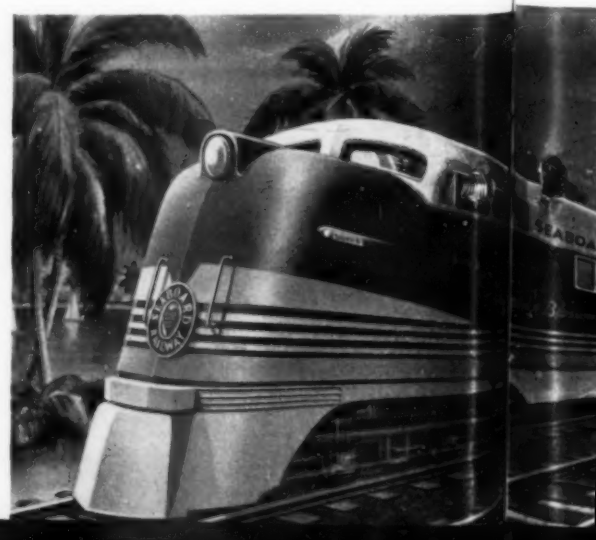
THE Seaboard Railway presented to the public on October 31 at the Union Station in Washington, D. C., the first of its new 6,000 hp. Diesel-electric locomotives. The train, which was open to the public during the entire day, is composed of the three sections of the locomotive, three pullmans, one coach, one diner, and one combination passenger and baggage coach, all newly refitted.

The locomotive dedicated on October 31 was the first of three such locomotives which have been ordered and which will be used to pull the East Coast Orange Blossom Special from Washington, D. C., to Miami, Florida. Service will be inaugurated on December 15, with through passengers from New York being able, for the first time, to travel the entire distance to Florida resorts on trains powered by electricity. The Pennsylvania's electrics will pull the train to Washington where it will be turned over to the new Diesel-electrics.

The complete locomotive is 210 ft. long, 13 ft. 11 in. high, 9 ft. 10 in. wide, and when equipped for service, weighs 900,000 lbs. According to the announcement by the railroad, the new 6,000 hp. Diesel-electric streamlined locomotives, built by the Electro-Motive Corporation, are the longest and most powerful yet designed. Each locomotive is comprised of three 2,000 hp. units, coupled together, and operates from a single control station in the cab of the leading unit. In turn, each of the 2,000 hp. units is composed of two 1,000 hp. Diesel-electric power plants, controlled simultaneously from the main locomotive throttle. The length of each unit over coupler pulling faces is 70'0".

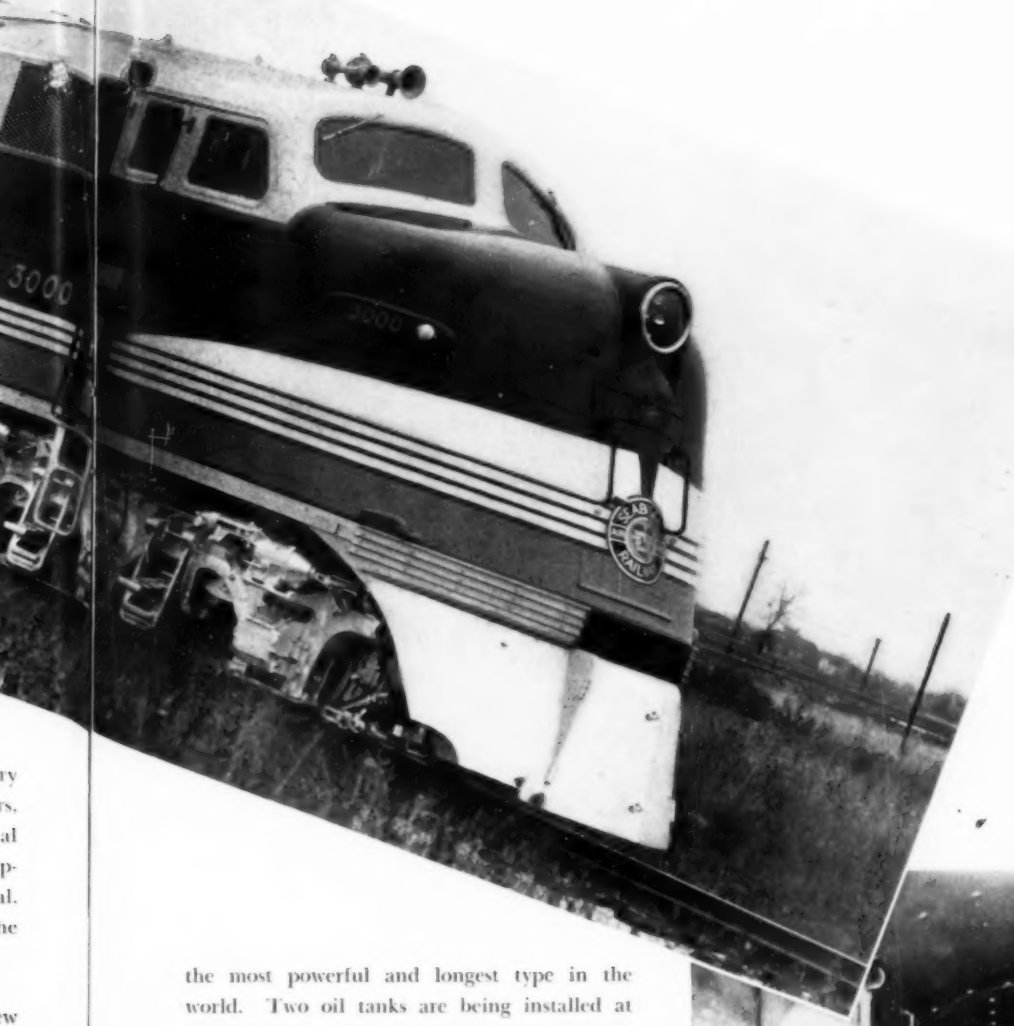
The essential units of each 1,000 hp. power plant comprise in general—an engine with its attendant cooling, fuel, and lubricating oil systems, power generator and exciter, battery charging generator, and the necessary contactors, switches and fuses for the control of electrical circuits. In addition to two such power equipments, each locomotive unit carries a 1,200 gal. fuel tank and a 1,100 gal. water supply for the train heating steam boiler.

Preparations for the fueling of the nine new Seaboard Railway Diesel locomotives in their runs to and from Florida are advancing rapidly. It will require only two stops between Washington and Miami, and return, for fueling the new 6,000 hp. Seaboard Diesels,



LOCOMOTIVES FOR SEABOARD RAILWAY

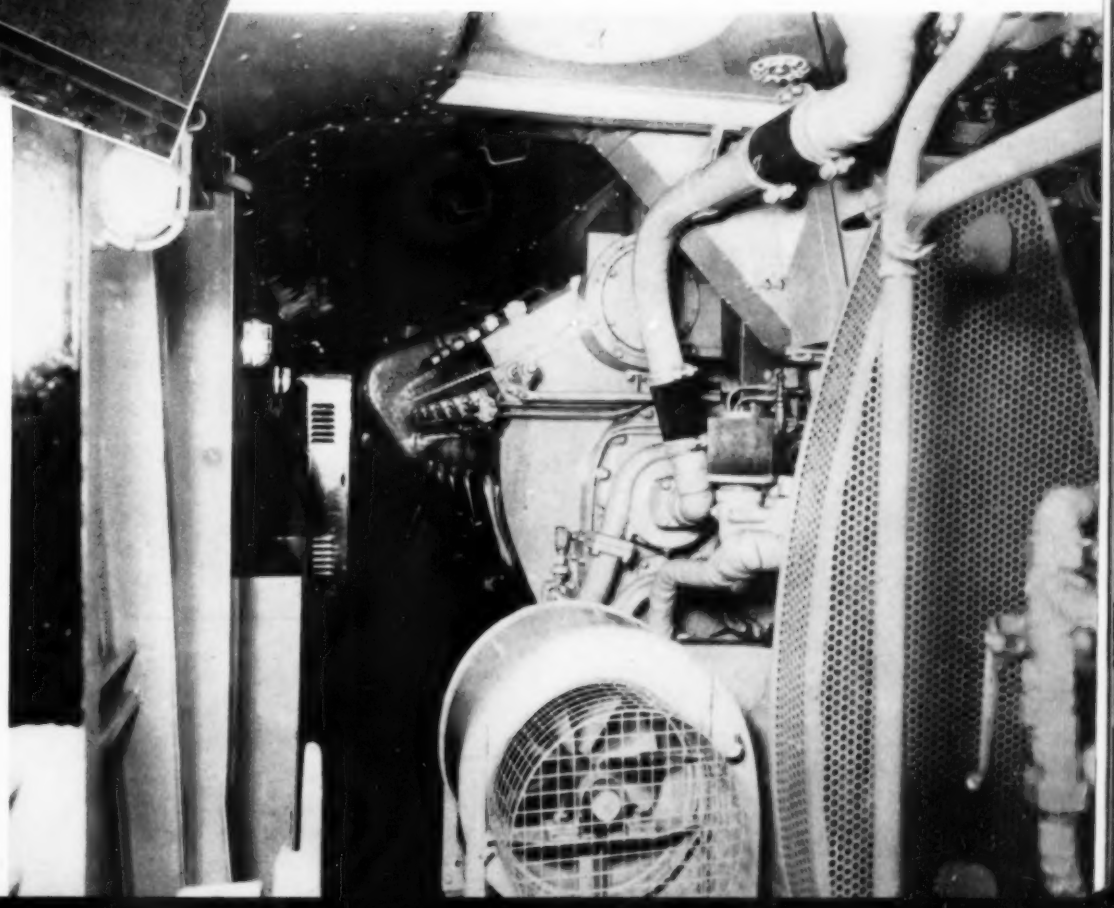
By GEORGE D. CROSSLEY

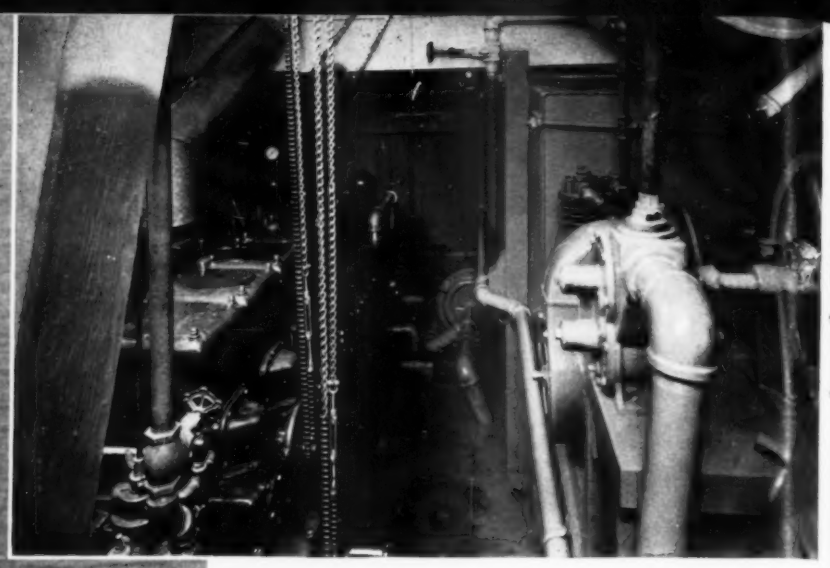


the most powerful and longest type in the world. Two oil tanks are being installed at Hamlet, N. C., with a total capacity of approximately 20,000 gal. of fuel oil, and they are to be equipped with pumps so each of the new locomotives can take on about 3,600 gal. of fuel each day. The tanks at Hamlet and Wildwood, Fla., are being located in such a manner that when the North and South Limiteds stop for other station purposes; such as watering cars, inspection, etc., the locomotives can take on oil at the same time. Ordinary fuel oil such as is burned in a household oil burner is the type to be used.

The engine is a "V" type, 12-cylinder, 2-cycle EMC Diesel, having an 8 in. bore and a 10 in. stroke, 7-bearing crankshaft, "Satco" bearings, drop-forged connecting rods, needle bearing wrist pins, aluminum pistons, lubricating oil and water pumps, and delivers 1,000 hp. at 800 rpm. Each of the six Diesel engines drives a 600 volt. DC electric generator which is a direct current machine used to supply power for the two 450 hp. traction motors mounted in the truck immediately below each power plant—two on each of the six-wheel trucks, making twelve motors for each three unit locomotive.

The new Seaboard Diesels will be able to travel at lower top speeds to maintain faster schedules, due to the ability of the Diesels to get up speed more quickly, to the fact that it is possible to stop more quickly, and to the more evident fact that the Diesels only have to stop for fuel and water at Hamlet and Wildwood. Their greater ability to maintain speed on grades is also a factor in eliminating the necessity of higher speeds on the straightaways. Automatic oil-burning boilers located in each unit of the locomotive provide steam heat for both itself and the passenger cars.





"ZEPHYR" and "JACKIE BOY"—TWO NEW PURSE SEINERS

By CHAS. F. A. MANN

IN SPITE of the sharp curtailment in construction of new fishing vessel tonnage on the Pacific Coast, the ever-busy Martinolich Shipbuilding Corporation plant has turned out eight large new boats this season, the last two being the *Jackie Boy* and the *Zephyr,* two heavy-duty seiners for use at Monterey, Calif.

Mechanically, the layout follows common practices as established by Northwest builders, yet, these two new craft are of particular interest due to their power plants. Both vessels are powered by the latest type Fairbanks-Morse 4-cycle solid injection, medium high-speed Diesels.

First to be completed in mid-August was the *Jackie Boy,* an exceptionally heavy seiner, for Joe Alioto of Monterey. The *Zephyr* is owned by George Rosin of San Pedro, Calif., and was finished on August 28, 1938. For all practical

purposes, the description of both vessels is identical except that the engines are of different sizes. The *Jackie Boy* has a 210 hp., 6-cylinder, 4-cycle Fairbanks-Morse Diesel developing its rated horsepower at a speed of 720 rpm., whereas 300 rpm. is the standard Pacific Coast practice. The *Zephyr* is powered with an identical engine having eight cylinders and is rated at 280 hp. These new F-M Diesels are much lighter in weight: they have Bosch type injection systems and are equipped with a Falk 2:1 reduction gear and a remarkably quick acting Falk Airflex remote-controlled air clutch and reverse gear. On the trials it was possible to reverse these engines almost as quickly as direct-acting, 2-cycle engines with high-pressure air reverse system. Space occupied by these lighter weight engines is somewhat less vertically and a bit less in the width. Overall length is about the same, including clutch. Placing the main engine room well forward as is now the common practice in these extremely bulbous-nosed hulls, makes it necessary to save every pound of weight in machinery. The F-M light-weight model engines are a good step in this direction.

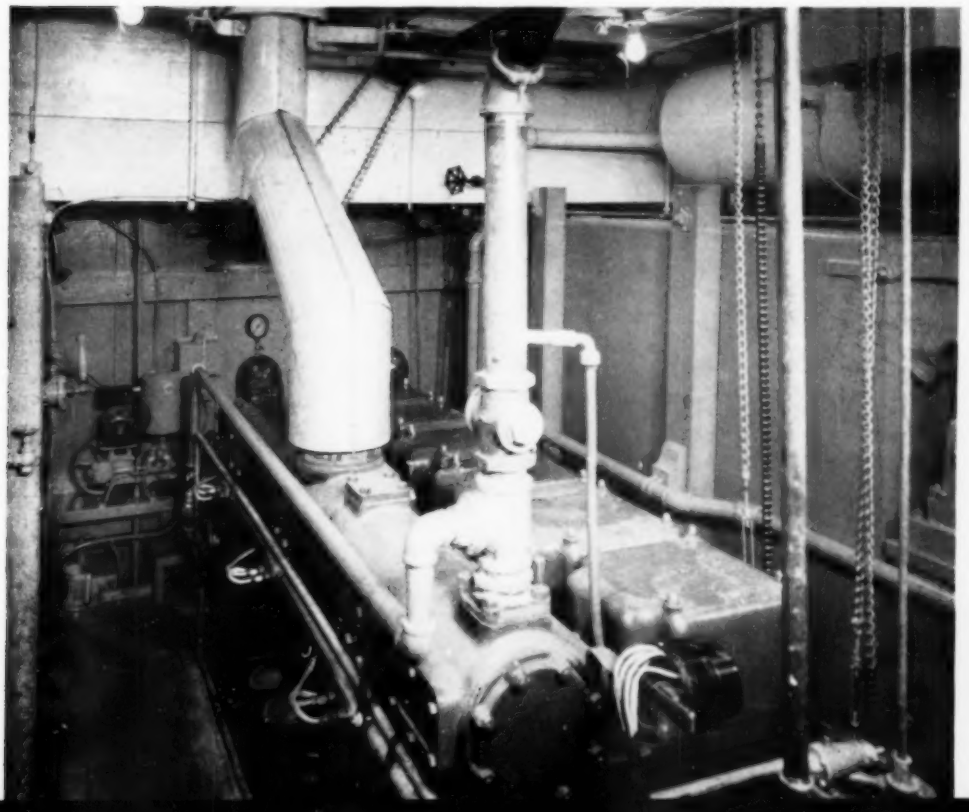
The hulls of these vessels are of heavy Douglas fir construction, 80 ft. overall length, 21-ft. beam and 13-ft. loaded draft. They will carry 140 tons of fish and are of 70 net tons register. Keels are one single piece of clear fir and the rest of the hull, including ribs and planking, is solid enough for 20 years at sea. The reduction gearing drives, through the air-operated clutch, a 3-bladed 60" x 64" Coolidge propeller. A 25-cell Edison battery is placed far forward, under the winch. All auxiliaries, the power rolls on the turntable aft, winch, gypsies, and certain pumps are all driven from a single line shaft chain operated through a clutch at the forward end of the engine. The deck machinery was built by the Petrich Machinery Company. A water circulating and a stand-by pump are fitted, as well as a 2-in. Gould pump. The battery set is charged by a 3-kw. generator belt driven from the main engine flywheel. An unusual feature of the electrical installation is the use of an Ets Hokin and Galvan automatic voltage regulator. At all engine speeds, constant voltage is delivered automatically without the use of a hand operated rheostat. This simple little device is mounted on a separate panel in the engine room and makes it possible to have the engine room cleared of all hands when fishing or maneuvering. Under the old system, if nobody was around while changing engine speeds, the voltage changes would burn out the ship's lighting circuit or throw the battery circuit breaker. This is the first installation of its kind on the Coast.

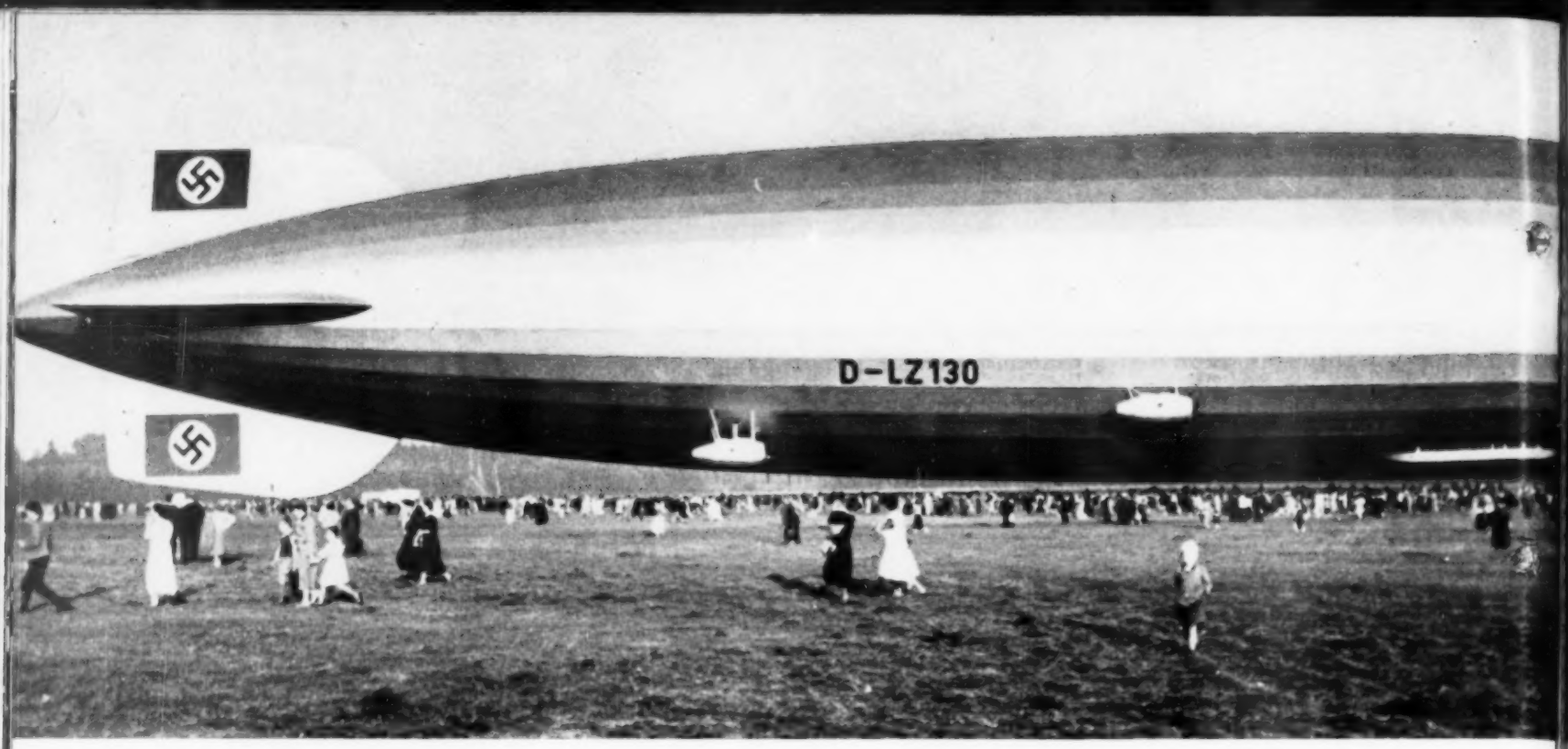
A 3-hp. Nelson air-cooled gas engine drives a 2-stage De Vilbiss air compressor. A Duro fresh water system is fitted, as well as a Lux 2-bottle CO_2 fire extinguishing system. Fuel and water tanks are carried in the after end of the engine room and in the after fish hold. Fuel bunkering capacity is 4,300 gal. and water storage is 1,000 gal.

The simple deckhouse has accommodations for a crew of twelve in roomy bunks with spring mattresses. A small enclosed pilot house is carried forward, with the main pilot house controls, including engine and clutch controls, located atop the deckhouse. The usual crows nest is carried on the heavy mast for sighting schools of fish. The galley is exceptionally roomy with a special Lang oil burning range, hot water system, tiled sink and tiled linoleum floors. A heavy skiff 22' x 11' and a small rowboat 12' x 5' are carried, as well as 200 fathoms of 32-fathom wide purse seine using Columbian ropes.

Mr. Anthony Martinolich of the busy shipyard calls special attention to the fact that these two boats are hulls 231 and 232 for the Martinolich yard, newest editions in one of the largest fleets of wooden ships ever built on the Pacific Coast by one yard.

Engine room of "Jackie Boy," showing the 210 hp. Fairbanks-Morse Diesel.





The new Zeppelin LZ-130, now known as the "Graf Zeppelin," is powered with four 1,200 hp. Mercedes-Benz DB-602 Diesels.

RENEWAL OF AIRSHIP ACTIVITIES

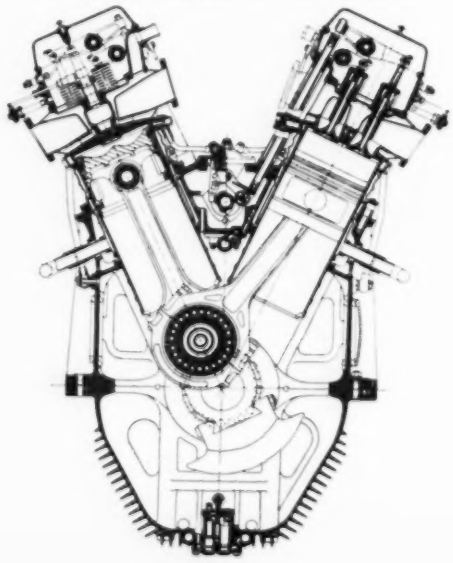
By PAUL H. WILKINSON

ONCE more, lighter-than-air craft are in the news, with reports from Germany that the new Zeppelin, LZ-130, has made its trial flights, and an announcement in the United States that the Navy will soon invite bids for the construction of a dirigible for training, experimental and development purposes. Despite the drawback of not having helium, the Germans have inflated their airship with hydrogen while they are working out a method of producing a non-explosive lifting gas on a commercial scale. They are using the same type of engine which was found to be so satisfactory on the LZ-129, and which is now known as the Mercedes-Benz DB-602 Diesel.

The United States, of course, will have the advantage of using helium in their airship, but it will be restricted to gasoline engines for its propulsive power unless something drastic is done to develop American Diesel engines for its needs. Gasoline engines will limit the range of action of the airship, and reduce its useful load, apart from adding a fire hazard which could be avoided with comparative ease. Undoubtedly, the Germans will find their substitute for helium and so, if we want our airship to be on a par with theirs, we had better start right away to develop our Diesel power plant.

The Zeppelin LZ-130, which recently was completed in the huge hangar of Luftschiffbau Zeppelin at Friedrichshafen on the shores of Lake Constance, made its first flight on September 14 with seventy-four people on board. After being christened "Graf Zeppelin" by Dr. Eckener, who used a small flask of liquid air for the occasion, the huge airship made some highly successful flights and was pronounced airworthy for passenger transportation. The transportation of passengers, of course, will have to wait until non-explosive lifting gas is available to fill the sixteen huge gas cells inside its framework.

End-section of a Mercedes-Benz DB-602 Diesel, showing the method of securing the cylinder barrels in the crankcase.



The LZ-130 takes its name from the LZ-127 which was retired early this year and is now on exhibition at Frankfort-on-Main. The LZ-127 was powered with five 550 hp. Maybach gasoline engines, and established a wonderful record for itself in the course of its visits to all parts of the world. The engines on the LZ-130 represent an increase in total engine power, of approximately 80 per cent, while the displacement of the new airship is about 90 per cent greater than that of the earlier one. Despite this difference in size and power, the LZ-130 actually costs less to operate than the LZ-127 on account of the outstanding fuel economy of its Diesel engines.

The four Mercedes-Benz DB-602 Diesels installed on the new airship, are rated at 1,200 hp. at 1,600 rpm., with a maximum power output of 1,320 hp. at 1,650 rpm. For cruising, the engine is run at from 1,400 to 1,480 rpm., at which speeds it develops from 800 to 900 hp. Its fuel consumption at cruising speed is only 0.375 lb. per hp. per hour which enables the airship to have a flight range of 7,500 miles at a cruising speed of 78 mph., carrying a payload of 30,000 lb. With slightly less payload, the

airship has a maximum range of 8,700 miles. This performance is far superior to that of any present-day airplane, or fleet of airplanes.

The engines used on the LZ-130 have sixteen water-cooled cylinders which are mounted in two banks with an angle of 50 degrees between them. The method of mounting the cylinders in, rather than on, the crankcase is a feature which appears to have much to recommend it. This method of support, with the flanges high up on the cylinder barrels, brings the location of maximum lateral pressure in line with the point of attachment. It has resulted in freedom from vibration without appreciable increase in weight, resulting in extremely smooth running up to the maximum speed of the engine.

It is claimed by Daimler-Benz, the manufacturer of the engine, that the arrangement of the cylinders at 50 degrees also plays an important part in the performance of the engine. It is said that this reduces vibrations within the operating range of the crankshaft speed to a negligible quantity. That this is so, is borne out in practice, as the engine is not equipped with a vibration damper. Peak pressures, too, have been held to less than 850 lb. per sq. in., which would be quite an achievement for a non-supercharged gasoline engine of similar size and power.

In addition to the main engines suspended in their streamlined gondolas below the hull for propelling the airship, there are also two Diesel-electric power plants on board which supply the needs for lighting, heating and cooking. These engines, which are also manufactured by Daimler-Benz, are four-cylinder, inline Mercedes-Benz OM-65 Diesels with a continuous power output of 50 hp. and a fuel consumption of 0.42 lb. per hp. per hour. One of the units is in constant use, while the other one is held in reserve. A 30-kw. Siemens electric generator of the totally enclosed type, is direct-coupled to each engine.

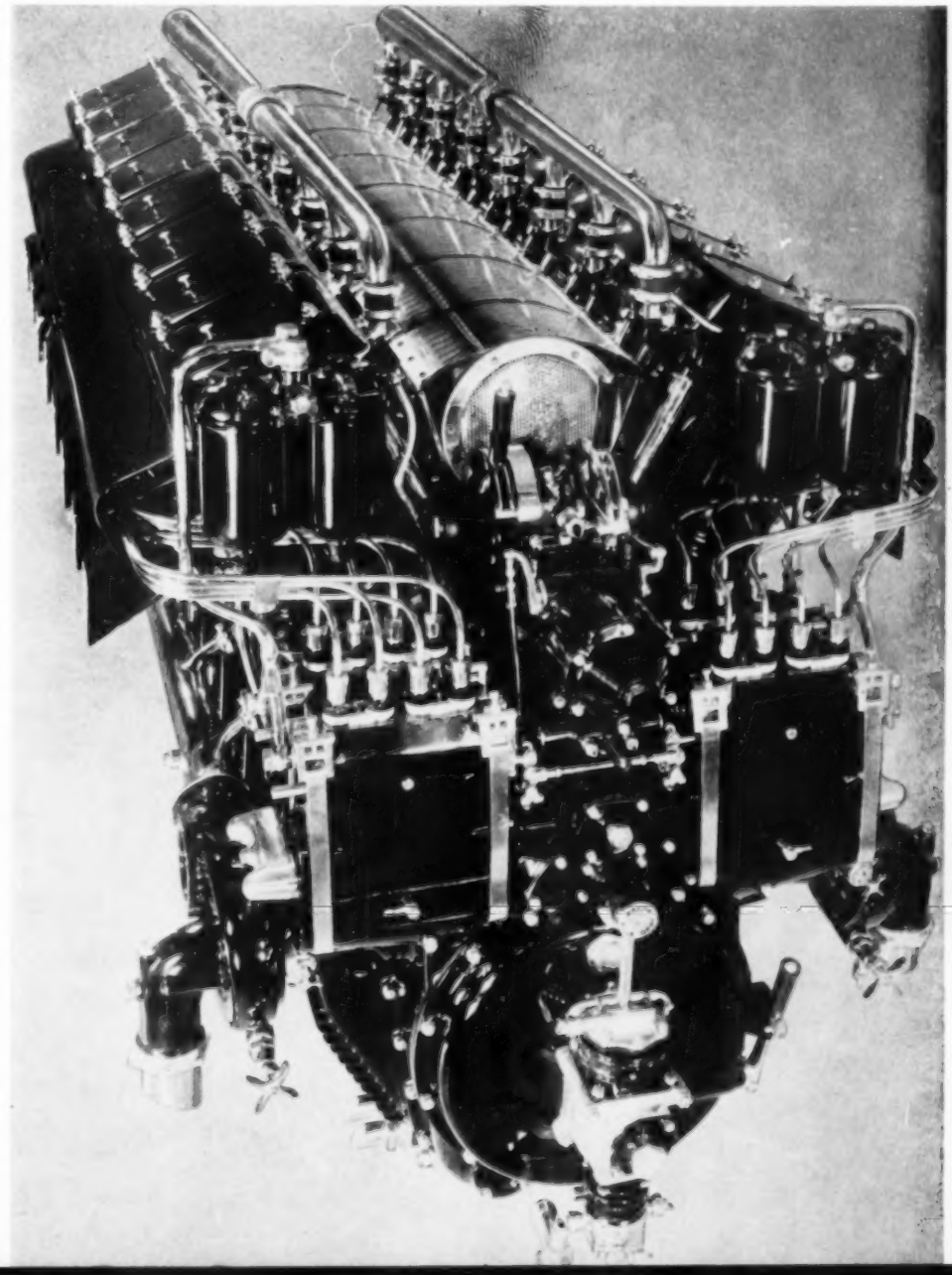
Further economy on the new airship is effected by a water recovery system which regains much of the water vapor from the engine exhausts and transfers it to tanks in the hull. This procedure adds weight to compensate for the weight of the fuel consumed, and eliminates much of the valving of valuable lifting gas which formerly was necessary to maintain the desired altitude in flight. The condensers used for this purpose are mounted around each engine gondola where they are in the slipstream from the large tractor propellers.

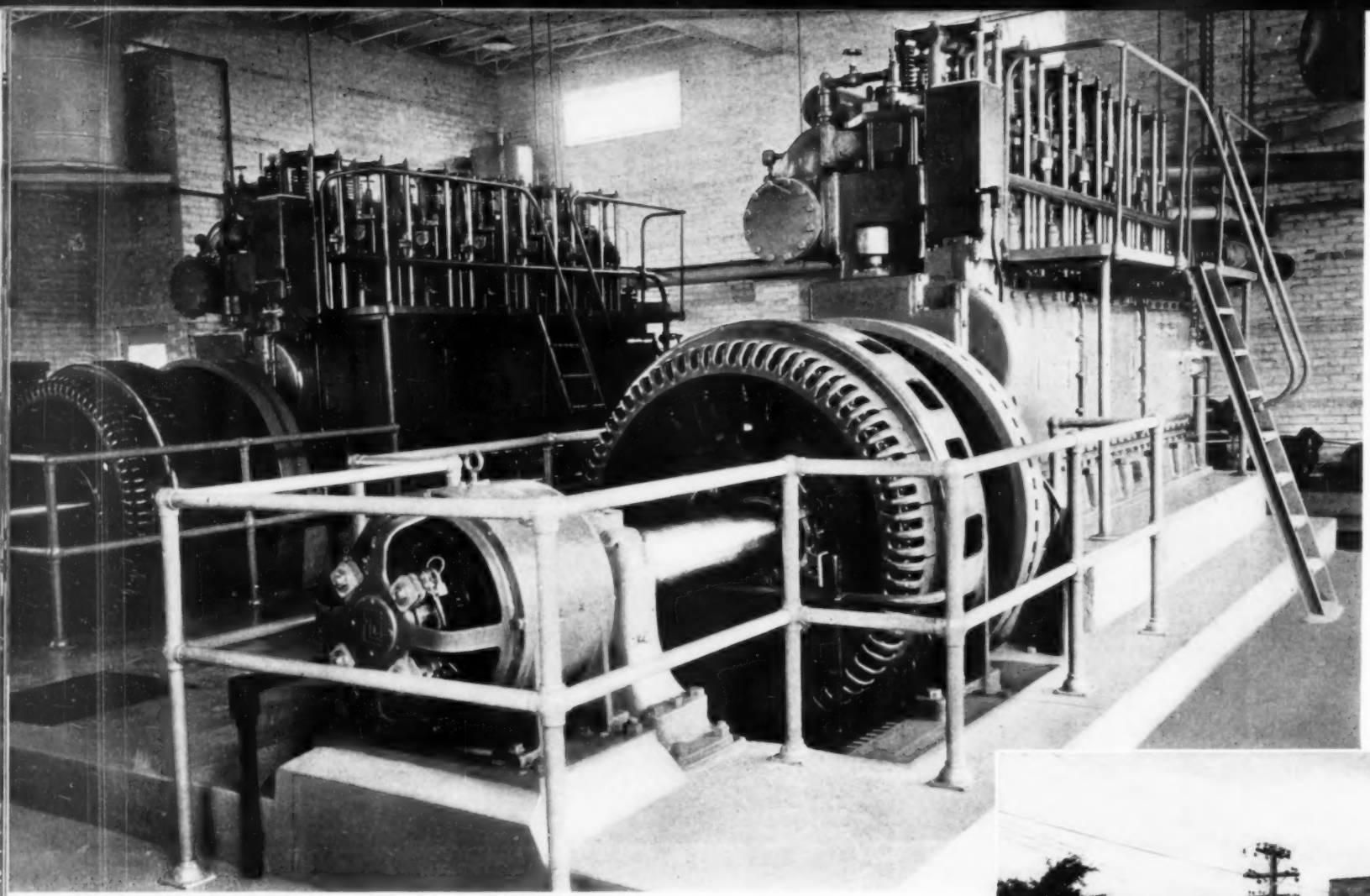
The overall length of the new "Graf Zeppelin" is 804 ft., and its maximum diameter is 135 ft. It has a volumetric capacity of over 7,000,000 cu. ft., and a gross weight of more than 220 tons. Its maximum speed is 84 mph., and it has accommodations for a crew of 40 and about 60 passengers.

The new United States Navy dirigible for which bids are soon to be invited, is considerably smaller than the commercial air giant that has just been completed in Germany. The American airship will have a volumetric capacity of approximately 1,000,000 cu. ft., and will be about 325 ft. long. It is probable that engines with a total power output of 2,000 hp. will be required for our airship, which presumably could be divided between four engines of 500 hp. each.

It should not be beyond the capabilities of our engine manufacturers to produce lightweight Diesels with which to power our airship, and as the engines would be of relatively low power, it is possible that air-cooled radials could be used. As $3,000,000 is to be spent on the airship, this should allow ample margin for the development and production of Diesel engines with which to power it.

Rear view of the Mercedes-Benz DB-602 Diesel. Four Bosch four-unit fuel pumps supply the fuel to the sixteen cylinders at a pressure of 1,600 lb. per sq. in.





Two Worthington Diesels, direct-connected to Elliott generators, installed at Eaton Rapids, Michigan.

Exterior of Diesel power plant at Eaton Rapids, Michigan.

EATON RAPIDS, MICH.

Another R.E.A. Project

By ORVILLE ADAMS *and* R. D. CAMPBELL

JUST two miles east of Eaton Rapids, in south central Michigan, the Diesel Generating plant of the Tri-County Electric Cooperative, and R.E.A. project, began serving rural homes in Eaton, Ingham, and Clinton Counties on July 20, 1938. The Diesel plant was installed at the site of a small hydro-electric plant on the banks of the Grand river where a dam impounds the river water.

Previously the hydro-electric plant had been furnishing current to a few customers in the vicinity of Smithville and in the village itself, the chief use of the plant, however, was to furnish current for the operation of the Miller Dairy Farms' modern dairy products plant, which installed and operated it as their own private enterprise. The generating equipment consisted of one 165 kva. hydro-turbine alternator operating at 150 rpm., and one 85 kva. hydro-turbine alternator set operating at 200 rpm. Since the available water head was only 12 feet the normal flow of the river was sufficient only for the operation of these two units.

When the Rural Electrification Administration decided to build a Diesel plant to supply power and light to the rural homes in this district, the site of the hydro-plant was found to be a logical place for the location of the new Diesel generating station.

This location had many advantages, such as central location with respect to the area served, an abundant supply of cooling water and other conditions favorable to operation. The most obvious engineering advantage, as well as economical consideration, was the results to be expected from the combination of the hydro and the Diesel plant, one supplementing the other, and under the same operating personnel.

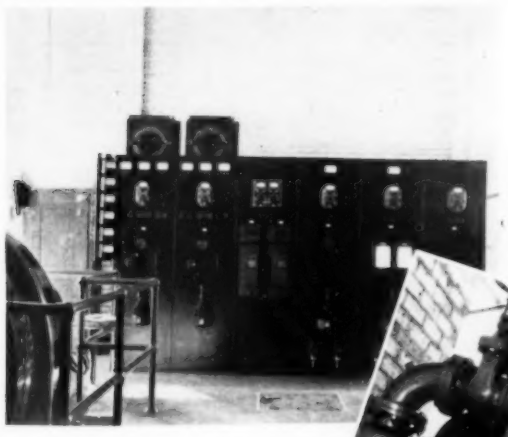
Features of the installation:
The new building required for housing the Diesel plant was built adjacent to the building in which the hydraulic turbines were operated. The Diesel equipment installed was as follows:

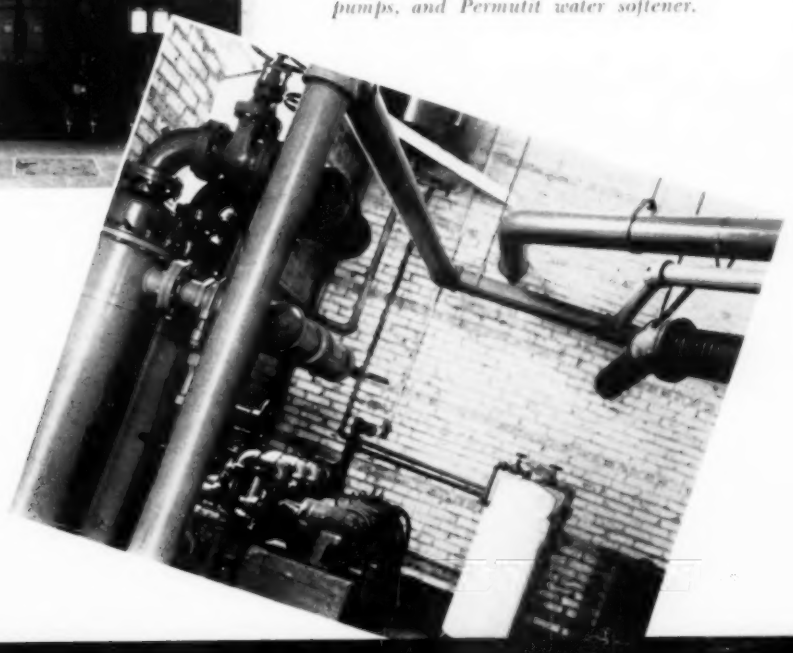
Two 6 cylinder, 13¼" x 16½", Type DS Worthington Diesel engines operating at 360 rpm., and rated at 500 hp. each. These engines are

direct-connected to two 432.5 kva., 345 kw. 3 phase, 60 cycle, 2,400 volt Elliott alternators. Each alternator has an extended shaft on which is mounted 10 kw., 125 volt direct-connected Elliott exciters.

The engines are equipped with American Air Filters of the viscous impingement type located outside the building and connected to the horizontal air intake manifolds extending from the engine through the walls of the building. In like manner, the exhaust headers, including a 10 in. section of flexible exhaust pipe about 5 ft. in length, are arranged to connect with a 10 in. diameter Maxim DO4 exhaust silencer. This layout effectively provides for thermal expansion and contraction, and the elimination of vibrations in the exhaust system.

The cooling system is known as the closed type, by which only the soft water is circulated in the engine jackets and is indirectly cooled by the raw water from the lake or mill pond. The raw water is pumped from the dam through Ross heat exchangers, while all the soft water is treated by means of a Permutit water softener, the soft water being continuously recirculated from the exchangers to the engine and back again, a practice that insures scale free operation. The circulating water pumps are connected in a unique manner, and arranged to give the maximum flexibility, economy, and to insure a continuity of service. All the usual connections are used, the pumps all have the same capacity, and each pump is arranged and has enough capacity to handle a sufficient quantity of water, either for the raw or soft water circuit for its engine. The two soft water pumps are arranged to handle either engine's cooling requirements. The two raw water pumps, pumping raw water from the lake, are arranged in a like manner for serving either engine. There is also a fifth pump, which is connected in such a manner that it can be instantly available for either the raw water or the soft water circuits, serving as a standby for the other four pumps. This multiple cross-connected arrangement has come into general practice where the utmost reliability is required. The flexibility of such practice is obvious. Any one of the three pumps is available for the soft water circuit, and also for use on the raw water circuit. The economy of this layout naturally follows, each pump being the proper size for either circuit of one engine, while only two pumps are required for each circuit when the two engines are in service. Adequate pump capacity is thus assured since the middle pump can be used to take the place of any one of the four other pumps, whether as a soft water or a raw water pump. These pumps are the Worthington Monobloc type, built on to 5 hp. 220 volt 3,450 rpm. motors, each having 2½ inch inlet and outlet connections. The fuel storage consists of two 20,000 gallon underground tanks, buried under ground adjacent to the river bank and about 100 yards below the power plant building, an arrangement that fully complies with the most rigid underwriters requirements.





At left, the main switchboard. Below, the Ross heat exchangers, service pumps, and Permutit water softener.

Michigan fuel is being supplied by trucks from Grand Ledge, Michigan, a distance of about 30 miles northwest of Eaton Rapids from the Bair Oil Company. The reported characteristics of this fuel oil is as follows:

Cetane Number	55
Flash Point	166° F.
Fire Point	230° F
Viscosity @ 100° F.	37.5 seconds
Carbon Residue	.004%
Heat Value	19,850 btu. per lb.
Gravity, °API	38.8
Weight per gallon	7.001 lbs.
Pour Point	15° F.

The lubricating oil used in the engines is the Shell Talpa Diesel oil having a viscosity equal to SAE 30 motor oil.

No operating records of interest are available as yet, since the plant has had only a short operating history. The number of rural customers is increasing as rapidly as facilities can be installed. Attractive operating figures are expected to be realized from the combined operation of two modern Diesel engines and two hydraulic turbines, an ideal arrangement for the highest possible running plant capacity factor and economy of operation. The current generated by this plant is distributed over 700 miles of line, and is transmitted at 7,200 volts, and stepped down to 110 and 220 for the consumer.

The usual auxiliaries now required by good Diesel practice are conveniently arranged. The selection and installation of the engine equipment is evidence of careful planning and the details of installation show good engineering. Briefly, this equipment comprises Woodward governors on each engine, overhead day fuel tanks with fuel level indicators for each engine, with which gear type fuel transfer pumps in duplicate are used. There is a completely modern switchboard, equipped with Ward-Leonard Mercury Vapor type of voltage regulators, an Easterline Angus recording wattmeter and recording voltmeter, and other usual apparatus. A chain block and trolley are mounted over each engine and each engine is equipped with a water temperature alarm system.

A Skinner Super Filter is installed in this plant and an illustration of this installation appears on page 67. Lubricating oil from both engines constantly passes through this filter, thus continuously removing injurious impurities from the lubricating oil.

The U. S. Engineers' new Diesel Tug "Stephen F. Austin," powered with a 450 hp. Fairbanks-Morse Diesel engine.

TUG "STEPHEN F. AUSTIN"

By GEORGE D. CROSSLEY

ONCE again the U. S. Engineers under the capable supervision of H. H. Haas, Senior Engineer, have turned out a very successful vessel in the tug *Stephen F. Austin*, which was recently completed at Baltimore by the Spedden Shipbuilding Company, Inc.

The *Stephen F. Austin* is a steel tug 100′ 7¾″ x 22′ 8¾″ x 10′ 6″ and has been assigned for duty out of the Galveston, Texas, office of the U. S. Engineers.

The main power plant consists of a 5-cylinder 14″ x 17″ Fairbanks-Morse mechanical injection, 2-cycle Diesel engine developing 450 hp. at 260 rpm. and the auxiliary equipment consists of a pair of 20 kw., 120 volt DC generators, driven by 6-cylinder 4½″ x 5¾″ Superior Diesel engines.

One of the most interesting features of this compact, well designed tug boat is the fact that the main engine is mounted on Korfund Vibro-Isolators and connected to the Kingsbury thrust through a Farrel-Birmingham floating shaft flexible coupling. This is one of the first installations of a heavy duty engine of this type for marine service mounted on a spring foundation, and congratulations are due to the U. S. Engineers for their progressiveness in applying this method of vibration elimination to boats, although this type of isolation has been used successfully for several years in industrial applications.

The auxiliary equipment throughout this vessel is well chosen and very complete, consisting in the main of Vortex Air Intake Mufflers mounted on the upper deck and exhausting through a Vortex Spark Arrestor Silencer mounted in the stack. A Nash single suction, single stage, Jennings self-priming centrifugal fire and bilge pump. A complete closed engine cooling water system consisting of the Fairbanks-Morse salt water cooling pump and a Schutte & Koerting heat exchanger.

The vessel is provided with a Sperry electric steering gear and an American Engineering Company electric driven capstan, a Sperry searchlight and Kahlenberg twin horns mounted on top of the pilot house.

Accessories used in connection with the main and auxiliary power plants consist of Brown pyrometers, Weston tachometers, Nugent fuel oil filters, Purolator Luboil filters and Pierce governors on the Superior auxiliary units.

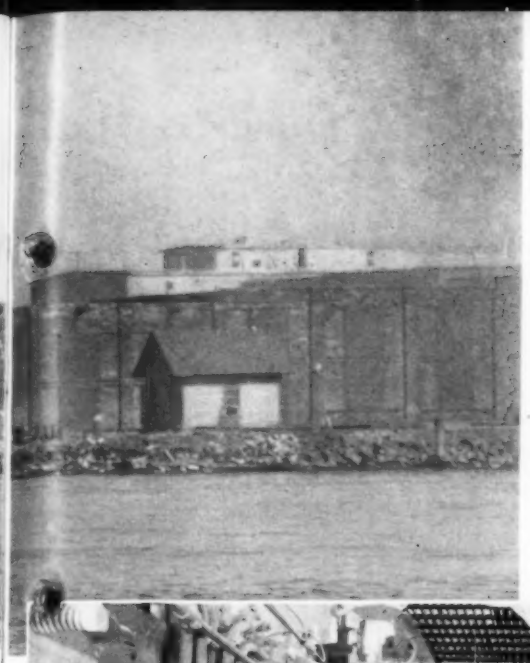
Both the main and auxiliary engines are equipped with Viking safety controls to protect the cooling and lubricating systems. The automatic controls operate a signal system on the forward engine room bulkhead, with a dial for each system protected that is illuminated under normal operating conditions – a horn sounds when pressures fall or temperatures rise above the normal.

The hull, main house and pilot house is constructed of A. M. Byers Company genuine wrought iron plates: riveted and electrically welded in accordance with the latest rules of the American Bureau of Shipping and the U. S. Bureau of Marine Inspection and Navigation.

Below the main deck are located a forward peak tank and chain locker, crew's quarters, cook's stores, cook's stateroom, fuel oil tanks, main engine room, hold space for air tanks, and after peak tank, over which is a storage space.

In the main deck house forward are located the galley and mess room, next aft chief engineer's and mate's staterooms, deck gear lockers, officers' and crew's toilets and showers. On the upper deck is the pilot house and aft of this is the captain's stateroom. The galley is equipped with a Kelvinator refrigerator and Elisha Webb-Perfection coal stove.

A fresh water system is provided, consisting of a Fairbanks-Morse automatic pressure water system to deliver fresh water to the galley and all wash basins. A sanitary system, similar to the fresh water system, is provided to furnish sea water to the showers and all toilets.

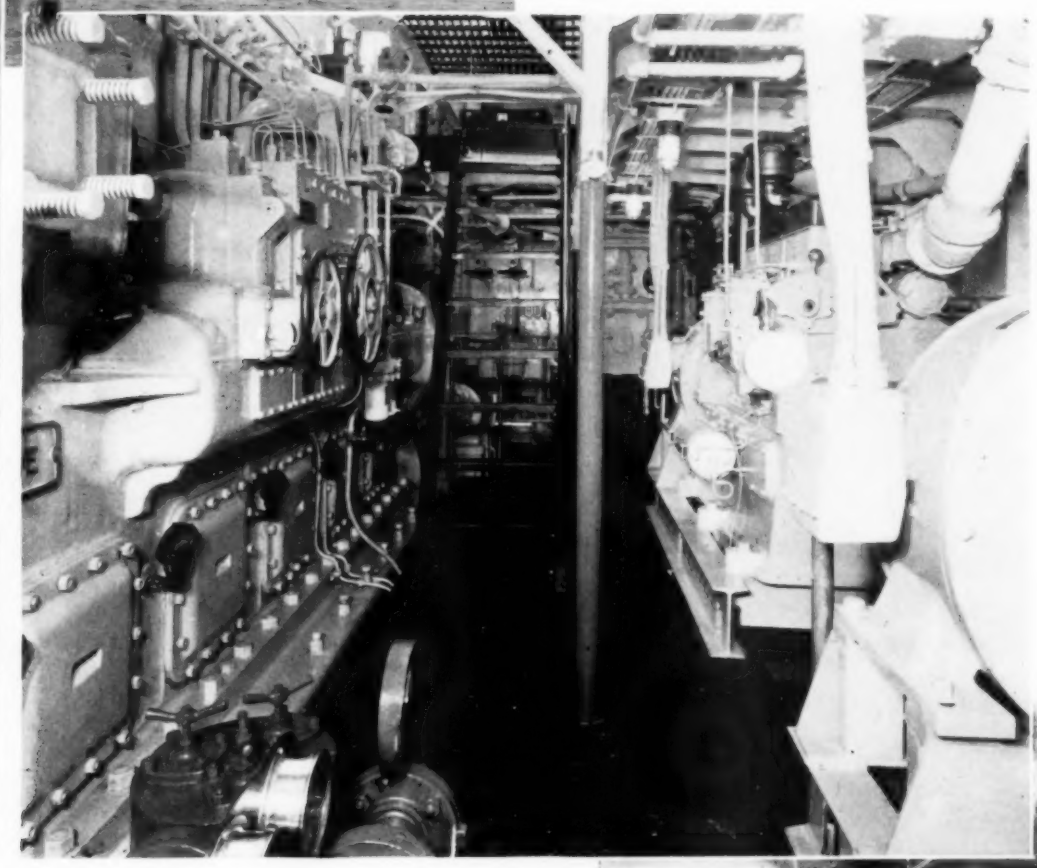


The pilot house following normal practice is built on top of the deck house and is high enough to give good vision aft through the windows in the rear. Steps from this pilot house lead to the captain's quarters. In this pilot house is found the usual binnacle with a Kelvin-White compass, light switch panel, engine room telegraph, operating mechanism for the Sperry searchlight and control cords for the Kahlenberg twin horns and of course the steering stand with large wheel operating the Sperry electro-mechanical steering gear.

Starting air is supplied by a motor driven Ingersoll-Rand air compressor and is stored in six tanks in a compartment aft the engine room. In this same room is the Diehl motor with shaft extending through the deck operating the capstan in close proximity to the towing bitt.

A Sharples centrifuge is located in the engine room for purifying the lubricating oil for both the main and auxiliary engines and a 56 cell Exide battery is likewise located in the engine room for supplying current for lights, small motors, etc., when the auxiliary engines are not in operation.

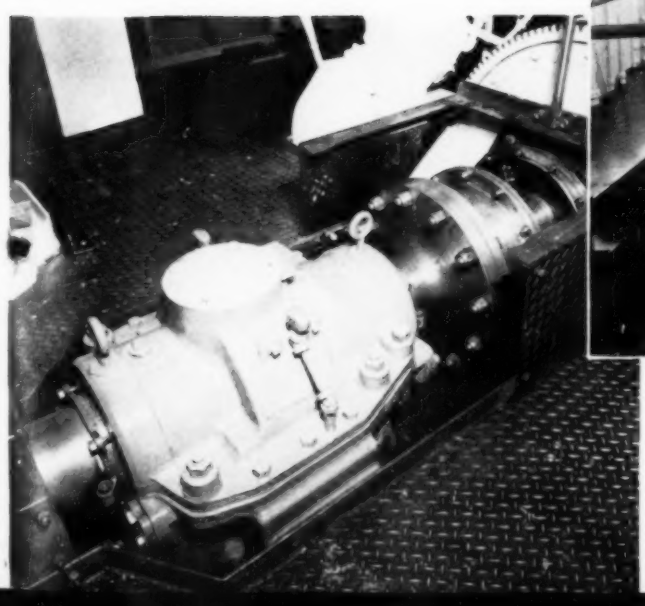
All in all the *Stephen F. Austin* is a fine type of modern Diesel tug boat, incorporating the last word in engineering and equipment.

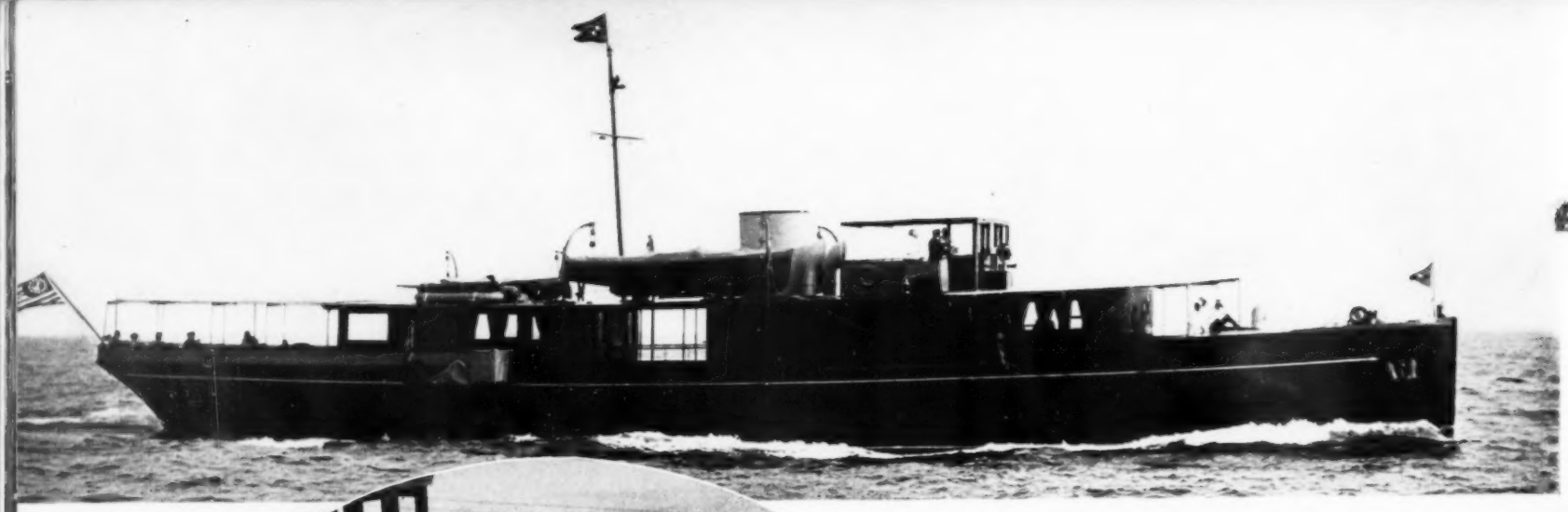


At left — main engine room showing Nugent filters on fuel line and Motoco thermometers on water line. Superior auxiliary units at right with Pierce Governor.

Below — Upper platform showing top of the 450 hp. Fairbanks-Morse main engine.

Below to the left — Farrel Birmingham Gearflex coupling and Kingsbury thrust bearing.





BEAUTY NOW WORKS FOR A LIVING

By GEORGE D. CROSSLEY

FROM basking in warm sunshine, to carrying bananas in tropic heat and under a business-like schedule is a far cry, but that is just the change which has transpired in the life of the Diesel powered vessel now carrying the name *Berlanga*. From following the seasons as a trim pleasure craft, this 128-foot beauty comes now to making regular runs from Cuba and British Honduras to Tampa, Fla., with her hold loaded with that ever popular basis of salads and crown for cereals, the banana. Between her debut in the early twenties and her transformation in these late thirties, there lies a rather interesting biography.

Built in 1924 as a strictly luxury craft, this vessel was originally powered with two gasoline engines. Changing hands in 1933, her new owner ordered the gasoline engines removed and Cooper-Bessemer eight-cylinder Diesels installed by dismantling and lowering through the vessel's stack. From 1933 until spring of this year the yacht continued to serve as a pleasure ship. Then came the change! Not a change in her power plant, for her Diesel engines were just what N. Geraci & Company wanted in the way of economical power . . . no change in her lines, for speed and ease of handling were two of her original requirements . . . but rather, a change in her mode of life, for her present owners had purchased the *Berlanga* for the express purpose of bringing the succulent yellow fruit from its native countries to these United States speedily and with a minimum of spoilage during the water voyage.

With a capacity of 6,000 bunches of bananas, any yachtsman can easily imagine the changes which have been made in her interior to allow for cargo. In speed trials, conducted after her present owners had rechecked and conditioned the Diesels, the *Berlanga* made 14.8 knots with her Cooper-Bessemer Diesels turning the twin screws at 460 rpm. These Diesel engines are rated 350 hp. each at 525 rpm. and drive 46″ x 42″ Columbian wheels.

Somewhere we remember seeing that printed message, "You Wouldn't Buy a Racehorse for Plowing," or words to that effect. But, here you have that very transformation . . . and we leave it to N. Geraci & Company of Tampa as to whether or not that conversion has proven successful. Latest word from Chief Engineer Matthews indicates that the *Berlanga* is performing like a true thoroughbred, and without temperamental streaks. So, bring out another blue ribbon for modern, well-built Diesels and a business house with vision.

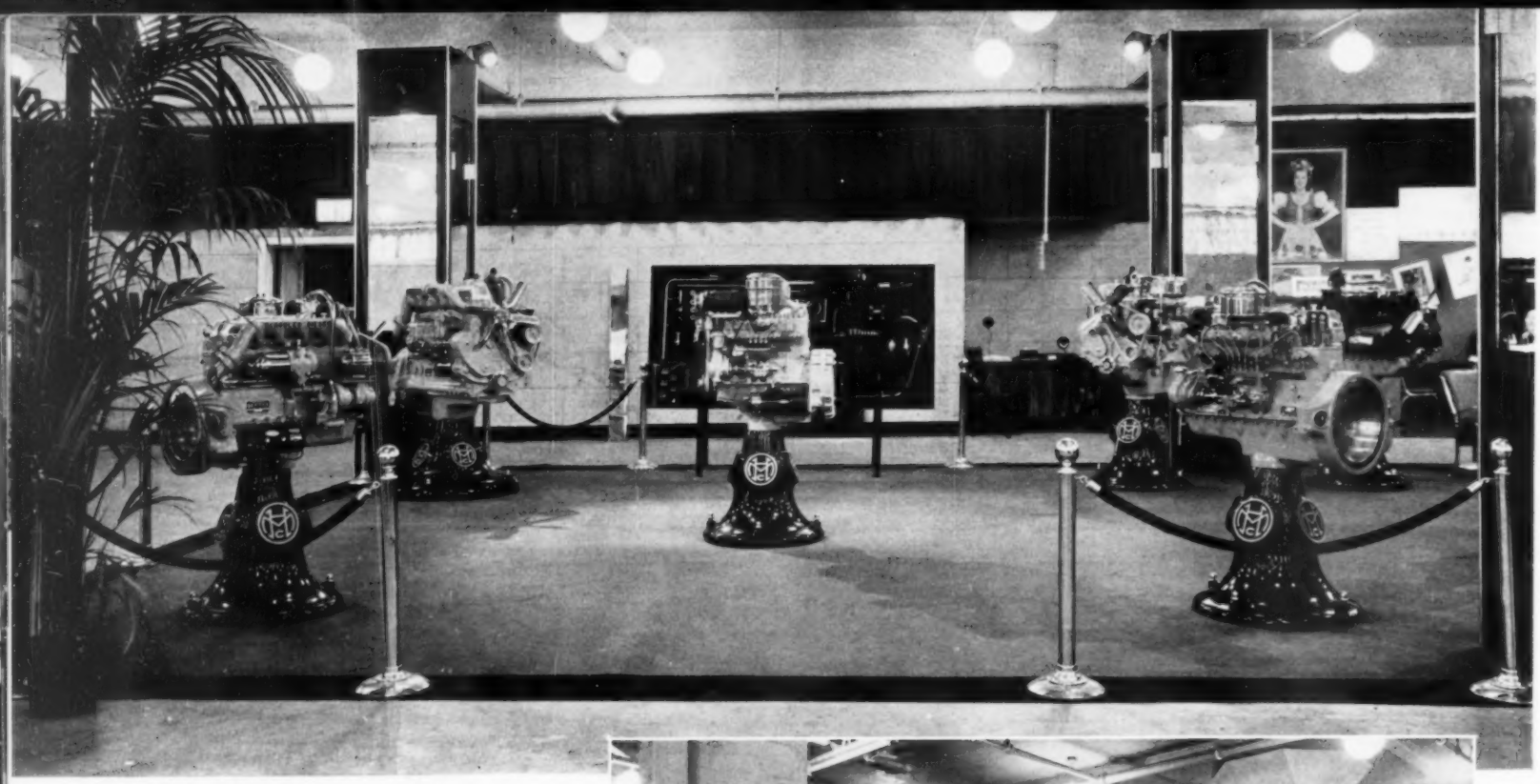
THE MOTOR TRUCK SHOW

By REX W. WADMAN

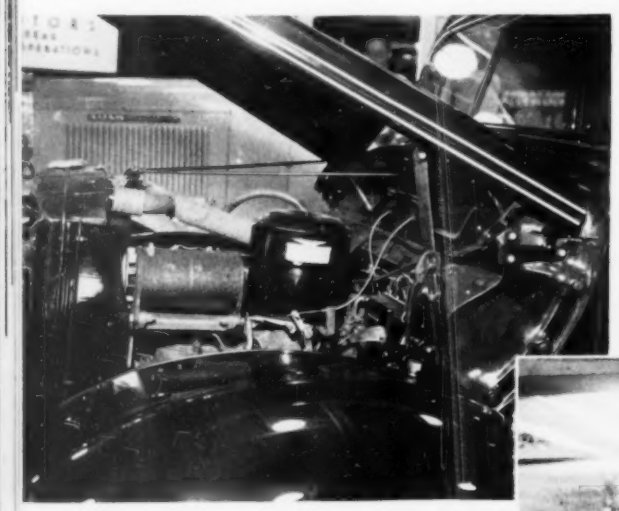
THE National Motor Truck Show which ran in New York from November 11th to 17th was a Diesel show from start to finish. Those truck manufacturers who did not have a Diesel truck in their exhibit were on the defensive throughout the week. Those manufacturers who did have Diesel trucks enjoyed a splendid volume both of interest and of business. The development of the Diesel for bus and truck service has been a slow and sometimes painful one. Today, however, the Diesel has arrived and the next five years will show an almost complete Dieselization of the bus service in this country and a very substantial Dieselization of the truck service. Satisfactory engines can now be obtained of the right size, the right weight and the right price.

The General Motors Truck exhibit was one of the largest from a Diesel standpoint in the entire show. The center of interest, of course, was the new GMC two cycle, four cylinder, 4¼" x 5" Diesel engine, illustrated above.

Twelve new Diesel models — six conventional and six cab-over-engine models especially designed for the medium and heavy duty truck field — all powered with the new General Motors Diesel engines — were announced at the show by the General Motors Truck and Coach Division.

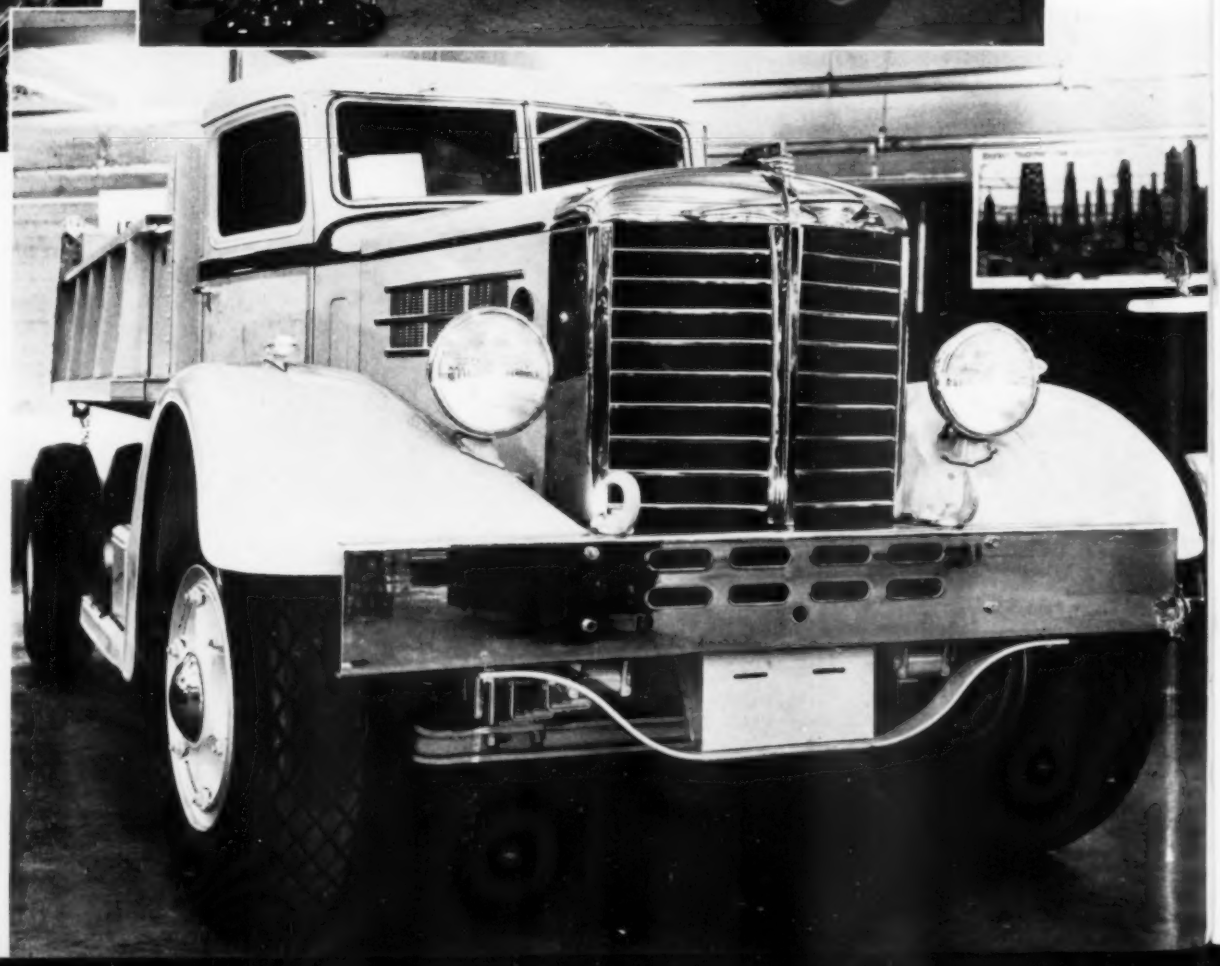


The exhibit of the Hercules Motors Corporation at the Truck Show. Engine in the center is the specially developed Hercules Diesel Ford truck engine replacement unit. A four cylinder, 4" x 4½", four cycle engine 226.2 cu. in. displacement.



Installation of a Hercules Diesel Ford replacement unit in a Ford V-8 truck in the Marmon-Harrington exhibit, illustrating how this compact Diesel unit fits into the space now occupied by the gasoline engine without any structural changes.

One of the standard six cylinder Hercules Diesel truck and bus engines standing beside a Marmon-Harrington truck in which it is installed.



Federal Diesel Truck, 135 in. wheelbase, equipped with a Model OJXC Hercules Diesel engine. Federal also exhibited a 167 in. wheelbase truck with a Model DOOC Hercules Diesel engine.

One of the features of the International Harvester exhibit was this Model DRD-70 ten ton capacity truck equipped with a six cylinder Cummins Diesel engine.

The International Diesel line, powered by Cummins Diesel engines, includes six four-wheel models, ranging in capacity from 3 to 7½ tons, with gross vehicle weight ratings from 17,200 to 38,000 pounds. Body, cab and payload allowances on the various four-wheel models range from 9,300 to 23,400 pounds.

The International Diesel line also includes six six-wheel models, ranging in rated capacity from 2½ tons to 15 tons, with gross vehicle weight ratings from 24,000 to 62,000 pounds. Body, cab and payload allowances for the six-wheelers are from 13,300 to 41,100 pounds. Four wheelbases are offered in each of the four-wheel models and in the two smaller six-wheelers. Three of the six-wheelers are available in three wheelbases and the largest model in two wheelbases.

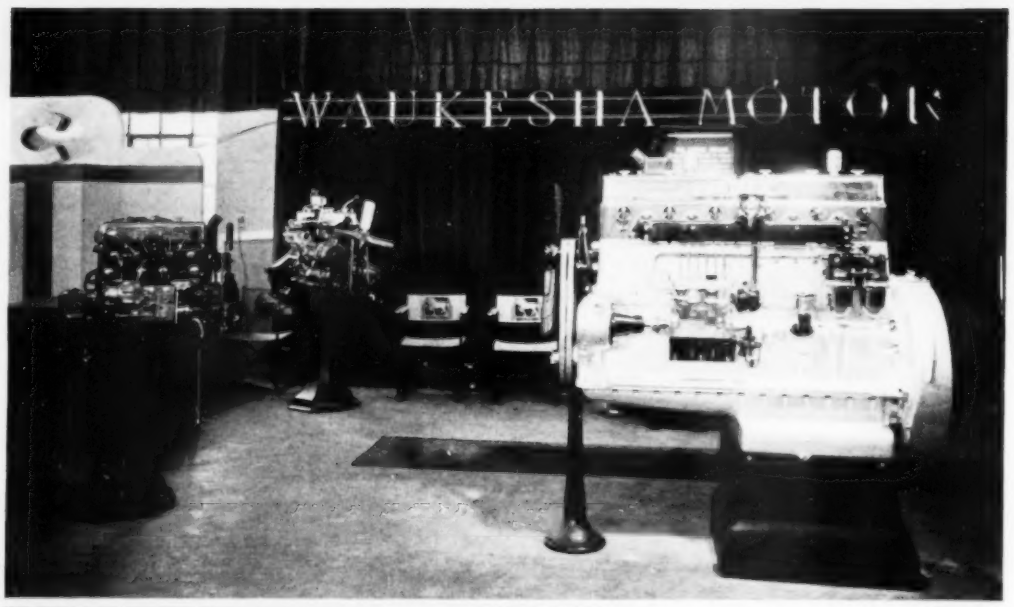
Diesel power plants in these Internationals are four and six cylinder types. Both engines have 4⅞ in. bore and 6 in. stroke, the four-cylinder having 448 cu. in. piston displacement and the six cylinder 672 cu. in. Air brakes are standard equipment on six cylinder models and available for four-cylinder units.

CUMMINS ENGINE EXHIBIT

The Exhibit of the Cummins Diesel Engine Company consisted of a complete line of their truck and bus Diesel models, also a sectional view of their fuel pump and distributing system to demonstrate the simplicity of its operation. Four trucks were exhibited: (1) Autocar, Model RLF, 3 ton truck equipped with a 6 cylinder 4″ x 5″ 377 cu. in. 100 hp. Cummins. (2) Mack, Model BX, powered with a 6 cylinder 4⅞″ x 6″ 150 hp. Cummins. (3) Sterling, Model JB90, equipped with a 6 cylinder 4″ x 5″ 100 hp. Cummins. (4) White, Model 710, powered with a 6 cylinder 4″ x 5″ 100 hp. Cummins. In addition, over in the White Truck Exhibit, there was a Model 722-TS White, rated at 7½-10 ton capacity, powered with a 6 cylinder 150 hp. 4⅞″ x 6″ Cummins, and in the Autocar Exhibit there was a 10 yd. capacity Autocar truck with a St. Paul hydraulic hoist and dump body, equipped with a 6 cylinder Model HB6 Cummins.

Autocar-Diesel truck as it stood in the Cummins Engine Exhibit. This is a Model RLF three ton job, powered with a 6 cylinder 4″ x 5″ Cummins.

The Buda Exhibit at the Truck Show, with the Ford truck conversion unit in the immediate foreground, which is referred to in more detail in this same section.



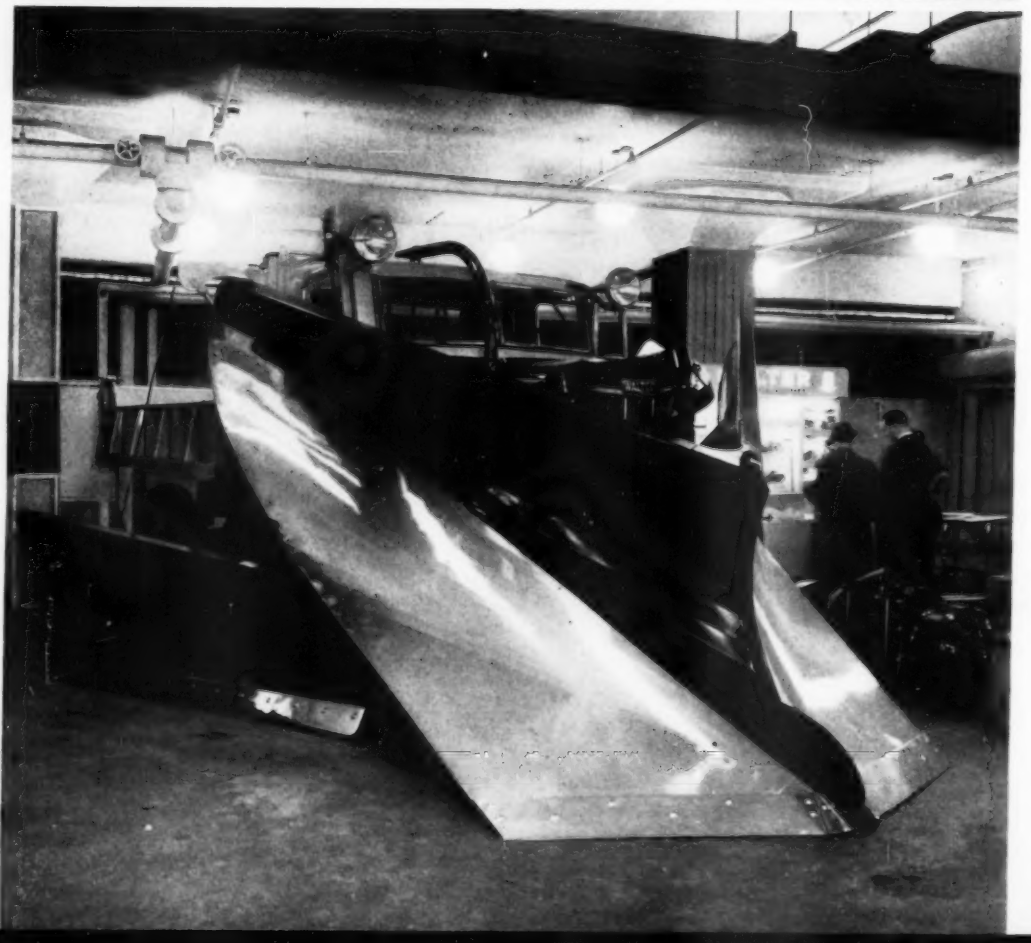
The Waukesha Motor Exhibit, featuring the newest Waukesha-Hesselman 200 hp., 6¼" x 6½", 6 cylinder, 1,600 rpm. Diesel engine, equipped with a Hesselman fuel pump which permits idling down to 200 rpm., 1,199 cu. in. displacement, 2,650 lbs. for use with either Diesel fuel, natural gas, Butane, Protane, or gasoline.

In the Diamond T Exhibit, two Diesel models appeared, both rated at 2½ to 5 tons and both powered with 6 cylinder 3¾" x 4½" Hercules Diesel engines. Diamond T has featured a line of Diesel trucks for some time now and is in an excellent position to ride in on the increased demand for and interest in Diesel-powered trucks.

IN CONCLUSION

This National Truck Show was an outstanding success, especially from the Diesel viewpoint. It has been a stiff, uphill fight to prove to the truck and bus operators of this country the economy and absolute dependability of the Diesel.

One by one the objections to the Diesel engine for truck and bus operation have been met and today the Diesel industry offers the owners and operators in this field a dependable, economical source of power which they can apply to their equipment to reduce operating costs, remove the fire hazard and modernize their fleets. With this Show we have entered a new era in the wide application of Diesel economy to the truck and bus field.



Walter snow fighter powered with a 6 cylinder, 5" x 6" Hercules Diesel engine. One of the eye-centers of the entire Show.

THE NEW DODGE-LANOVA DIESEL

By REX W. WADMAN

AT the National Motor Truck Show the Dodge Division of the Chrysler Corporation exhibited their new 3-ton Diesel truck in which was installed the new Dodge-Lanova truck Diesel.

The new engine is a full compression-ignition Diesel of 331 cu. in. displacement, with torque and power ratings of 226 pound ft. at 1,000 rpm. and 95 hp. at 2,600 rpm. A 14.5 to 1 compression ratio is used.

The engine is of the familiar 6 cylinder, 4 stroke cycle type with 3¾ in. bore and 5 in. stroke. Its general dimensions, mountings and crankcase structure are identical with those of the Dodge 3-ton truck gasoline engine, which permits notable economies in the manufacture and chassis installation of the engine. The design embodies such well-known Dodge features as full length water jackets, valve seat inserts, by-pass thermostat and chain driven camshaft. The cylinder block is of nickel-chrome-moly alloy.

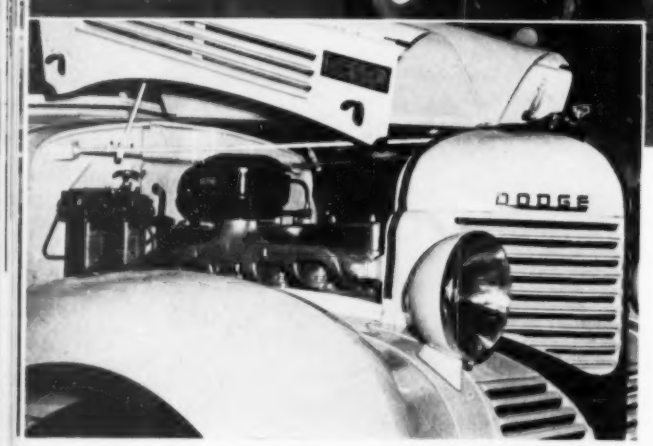
Tin plated steel strut autothermic pistons are employed in the new engine, permitting extremely close piston fits. Pistons are $5^{15}/_{32}$ in. long (plus the height of the displacer cast integral on top of the piston) to secure good crosshead effect. Three compression and two oil rings are used, the upper ring being ⅝ in. below the top of the piston so that it is always in contact with the water jacketed portion of the cylinder wall. The rings are tin-plated to prevent scuffing during the break-in period.

Seven precision-type replaceable main bearings, 3 in. in diameter, are employed, giving 36.89 sq. in. of projected bearing area. Copper-lead bearing material is used in conjunction with induction hardened crankshaft journals.

Connecting rods are $10^{7}/_{16}$ in. long, center to center, with 1⅛ in. diameter bronze piston pin bearings and $2^{5}/_{16}$" x $1^{7}/_{16}$" replaceable copper-lead crank pin bearings.

Full pressure lubrication is supplied to all main, lower connecting rod, and camshaft bearings, all valve operating mechanism, and the fuel injection pump. The latter feature eliminates the need for any attention whatsoever to the lubrication of the pump. Positive oil cooling is secured through the use of a water cooled oil gallery at the top of the crankcase and a 14-quart capacity oil pan. An extra large capacity replaceable element type lubricating oil filter is supplied as standard equipment.

The electrical system is full 24 volt throughout to provide adequate cranking ability without the difficulties sometimes encountered with combined 12-24 volt equipment. When starting, application of the full 24 volt potential is automatically delayed until after engagement of the starting motor is completed. An



The new 3-ton Dodge Diesel truck as exhibited at the National Motor Truck Show in New York.

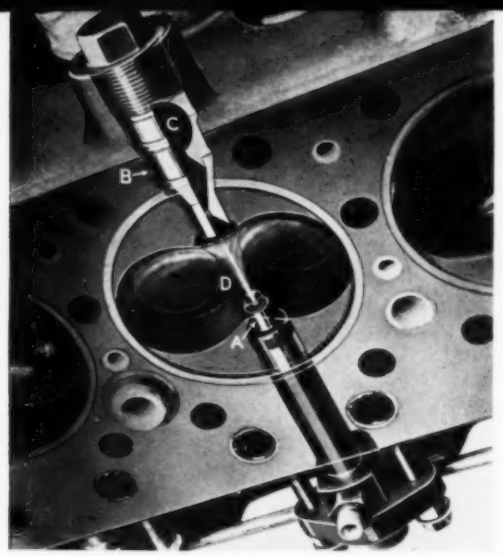
electric air heater is located in the intake manifold and equipped with an automatic time control switch to facilitate starting in cold weather.

Limitations imposed by the Diesel combustion chamber have forced Dodge to depart from its traditional L-head engine designs and to employ overhead valves in the new Diesel. Intake and exhaust valves are of 1.546 in. and 1.312 in. port diameter, respectively, with a lift of 0.375 in.

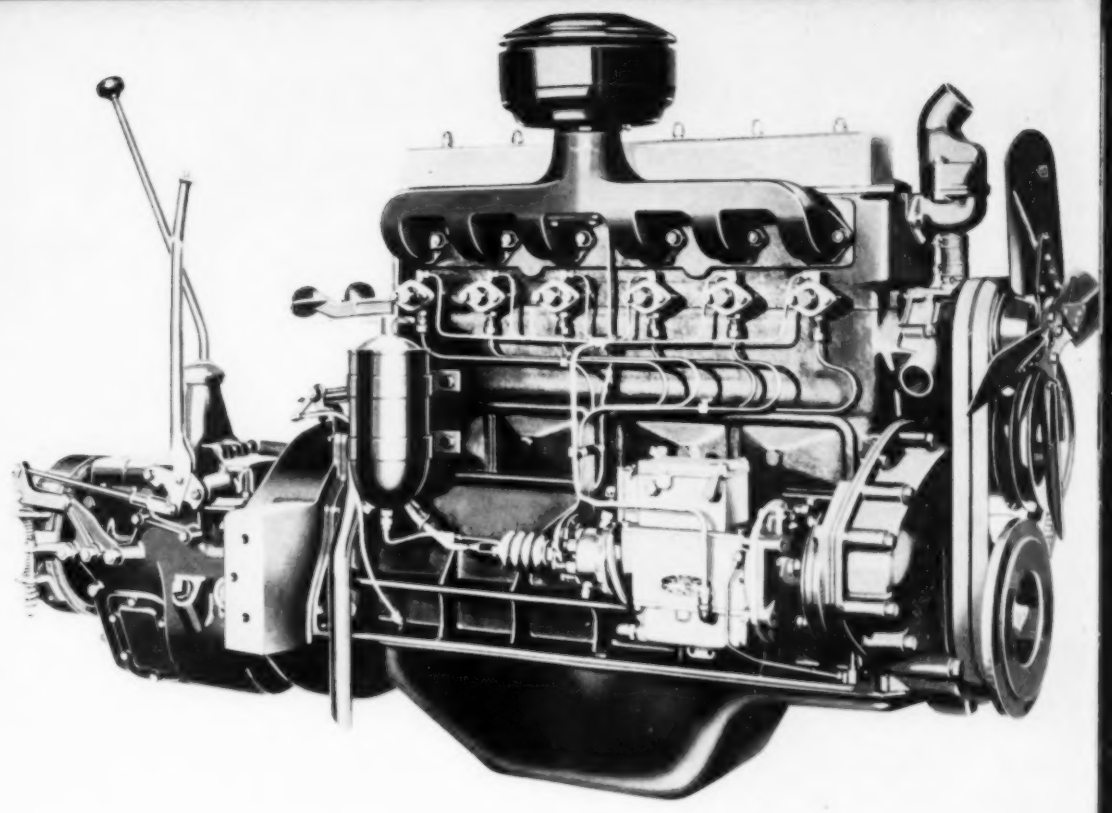
The combustion chamber is located in the cylinder head, and is of Lanova double-O shape with an auxiliary double chamber energy cell. With this design the fuel is injected across the minor axis of the chamber, a smaller portion of the charge entering the energy cell through a venturi-shaped passage simultaneously with the entry of air during the compression stroke. Combustion begins in the main chamber, giving the good cold weather starting and high speed qualities of the direct injection or open chamber type of Diesel. However, since most of the fuel is ignited within the confines of the energy cell, peak pressures are kept from pistons and bearings, and a high degree of turbulence is produced by the discharge from the cell. Thus the advantages of the pre-combustion or turbulence chamber type of engine, as well as those of the direct injection type, are incorporated in the Dodge design.

A nozzle of the familiar pintle type is employed, giving maximum freedom from plugging and carbonizing and resulting distortion of the spray pattern.

Of importance equal to that of the combustion chamber design in providing the excellent operating qualities of the Dodge engine are new features incorporated in the fuel injection pump – automatic control of injection timing in accordance with engine speed and speed-governed regulation of maximum fuel quantity. The desirability of advancing the timing of fuel injection and increasing the maximum fuel quantity with increasing engine speed has long been obvious and recognized, but heretofore unaccomplished. Now automatic injection timing is a reality. Instead of providing fixed injection advance with maximum operating efficiency at only one engine speed, the Dodge pump automatically times the start of injection at the optimum point in the engine cycle. Just as automatic control of ignition spark timing brought a notable improvement to gasoline engine economy and performance, so this new timing control embodied in the Dodge Diesel, together with speed-governed regulation of the quantity of fuel injected per cycle gives the new engine unprecedented flexibility and practical freedom from smoky exhaust.



Dodge Diesel controlled combustion: The Lanova energy cell "B" is charged with fuel from the core of the spray from the injection nozzle "A." The initial combustion takes place in the main chamber "D," the fine spray of the "envelope" burning first. The denser core is partially burned in the energy cell inner chamber "C," the high pressure so developed spraying the remainder of the fuel back into the main chamber and causing intense turbulence, which insures complete burning of the entire fuel charge. At the same time the rate of burning is controlled so that high pressures on the piston are avoided.

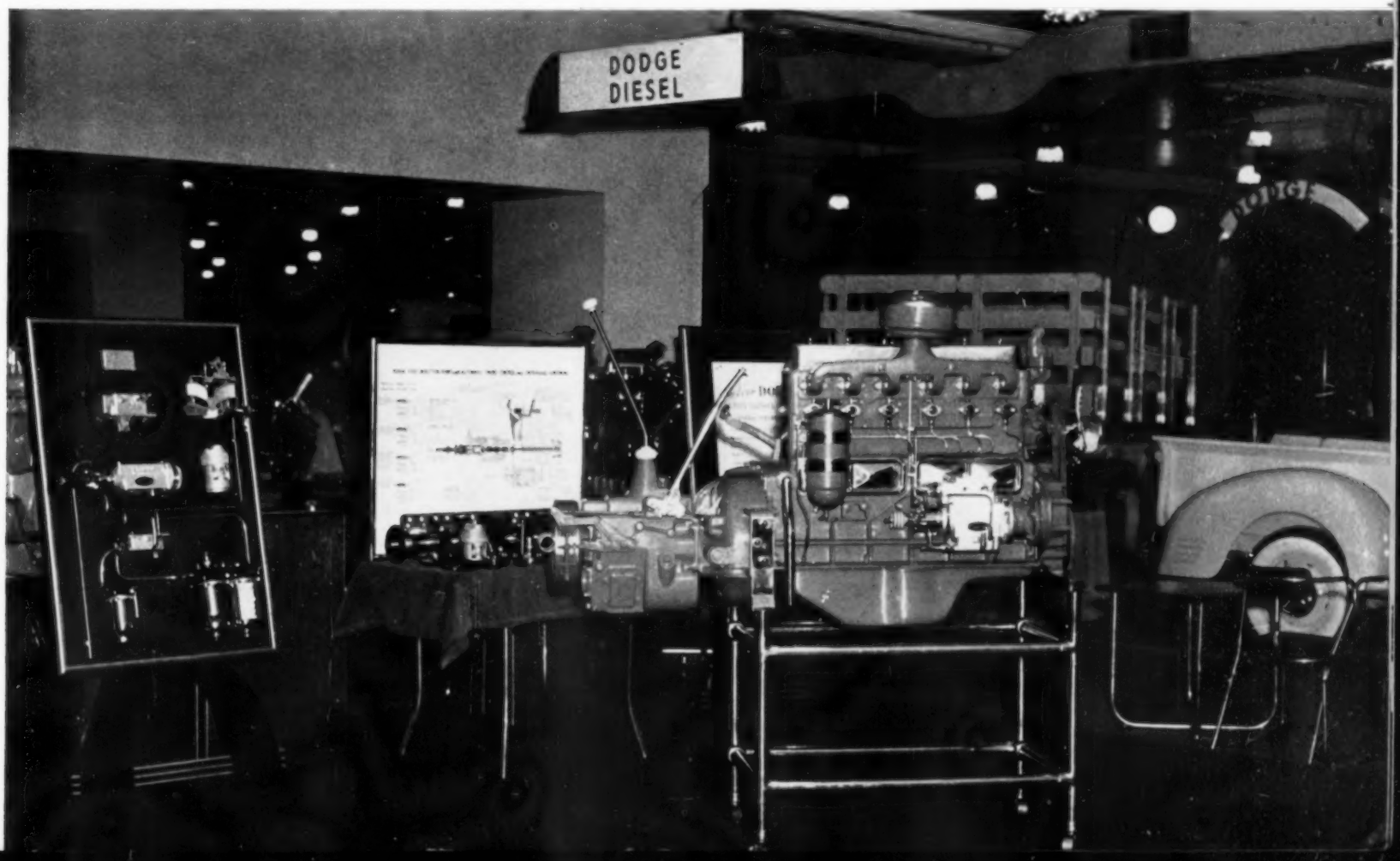


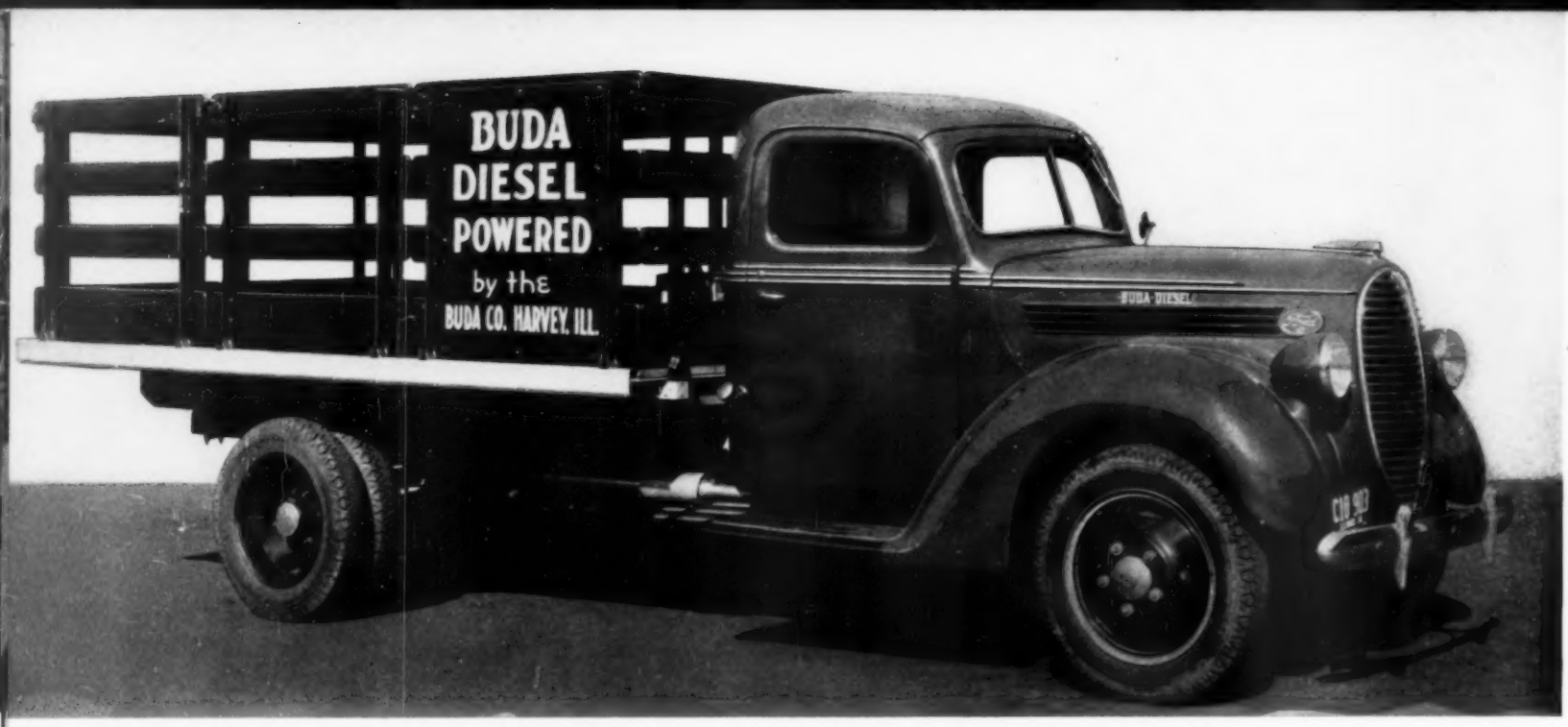
The new 6-cylinder, 95 hp. Dodge-Lanova Diesel truck engine.

The construction and operation of the pump are relatively simple. The axes of the six pump cylinders and pistons are arranged parallel to and in a circle about the axis of the pump drive shaft and mechanism. The six pistons are driven through tappets which are held by spring pressure in contact with a single rotating swash plate. Each cylinder is connected through a suitably shaped port to a central fuel supply chamber. Rotating within the supply chamber is a shaft carrying a valve with one triangular shaped section or land which, in passing over each port, closes it.

Operating results obtained with the new engine have been most satisfactory. Dodge Diesel-powered trucks have now operated many thousands of miles in all parts of the country under the direction of Dodge experimental engineers, and have also been subjected to routine commercial operation in the service of the Chrysler Corporation Interplant Transportation Department. Drivers have been most enthusiastic in their comments on the Diesel equipped trucks; fuel economy has been consistently at least 40 per cent better in miles per gallon than in comparable gasoline operation, and indications are that there is no appreciable difference in the maintenance costs of the two kinds of power.

The Dodge Diesel engine exhibited at the National Automobile Show at the Grand Central Palace in New York.





A Ford V-8 Truck equipped with a Buda-Lanova Diesel special conversion unit.

A BUDA-LANOVA DIESEL FOR FORD TRUCKS

By GEORGE D. CROSSLEY

THE Buda Company have engineered and designed a Diesel engine that will quickly convert any Ford Truck produced by the Ford Motor Company from the year 1933 to date into a Diesel truck. This engine is delivered as a complete unit, so designed that it will promptly fit the Ford Truck. All that it is necessary to do is take out the old gasoline motor and replace it with the Buda unit. No special engineering or fitting is required. All this has been taken care of in the unit. The work can be done quickly by any reasonably experienced motor mechanic.

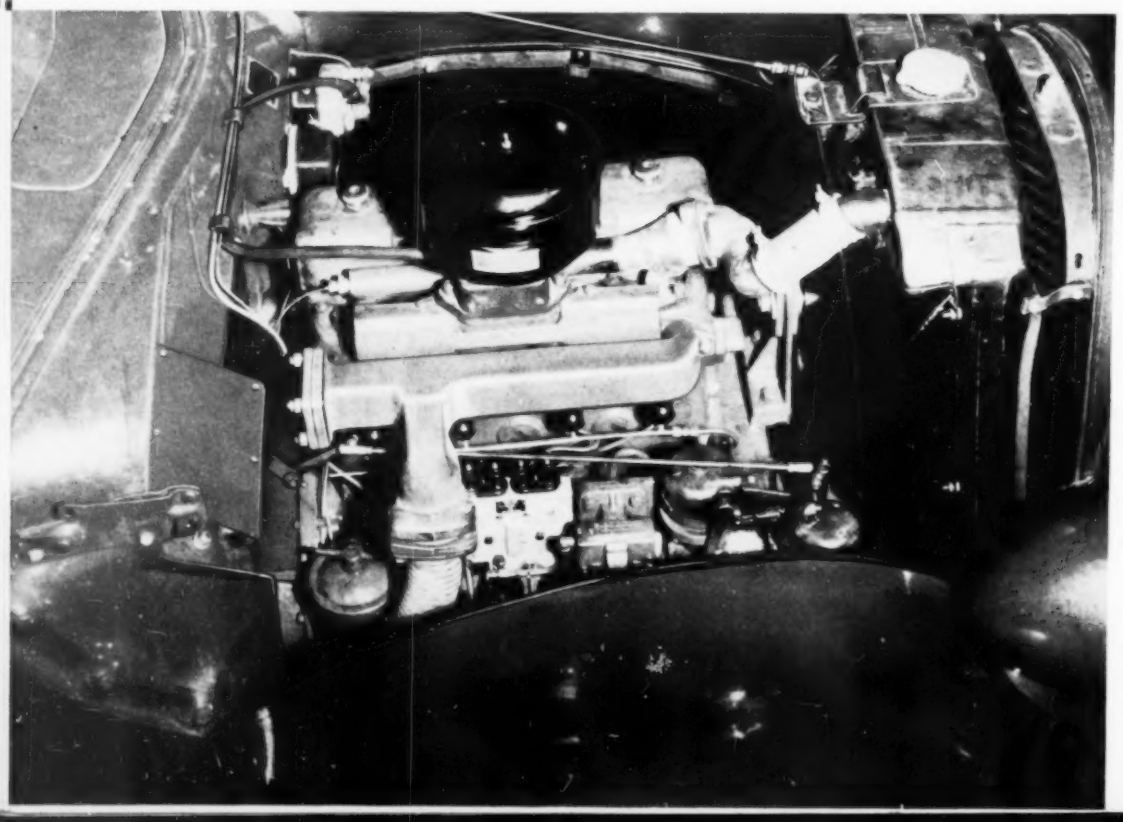
To meet the demand for new Ford Diesel Trucks, the Buda Company also supplies the latest model Ford Truck, left or right-hand drive, with a Buda Diesel engine installed at prices said to be strictly competitive with other Diesel trucks on the market today.

This is an important development because all motor truck and bus operations have become so competitive that it is necessary to find ways and means to reduce operating expenses in order to make a reasonable margin of profit. The availability now of a Buda Diesel unit for Ford Trucks, compact enough, light enough to fit into the space now occupied by the gasoline engine, offers operators of such trucks an opportunity of reducing their expenses at least one-half.

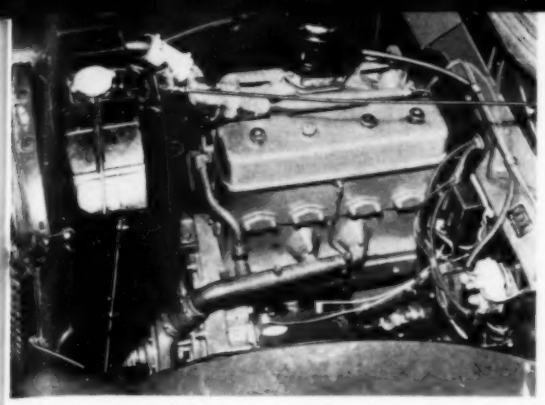
The principal expense of running a truck or bus, as we all know, is the cost of gasoline consumption. If these gasoline vehicles could be made to run on Diesel fuel, the cost of which in all countries is from one-third to one-fourth that of gasoline fuel, the operator of these vehicles will have solved his greatest and most troublesome problem – lower operating expense.

With this new Buda Diesel Ford conversion unit thousands and thousands of Ford Truck owners the world over can convert their present gasoline trucks into Diesel trucks with little expense or mechanical difficulty.

The Buda-Lanova 4-cylinder Diesel unit developed for this Ford conversion service is their standard model 4-DT-212, bore 3⅝", stroke 5½", incorporating all of the features which have gone to build up the enviable reputation for dependability and performance that characterizes the full line of Buda-Lanova Diesel engines.



A 4-cylinder, 212 cu. in., Buda-Lanova Diesel engine installed in a Ford V-8 Truck.



The Buda-Lanova Diesel Ford conversion unit fits into exactly the same space as now occupied by the V-8 gasoline engine.

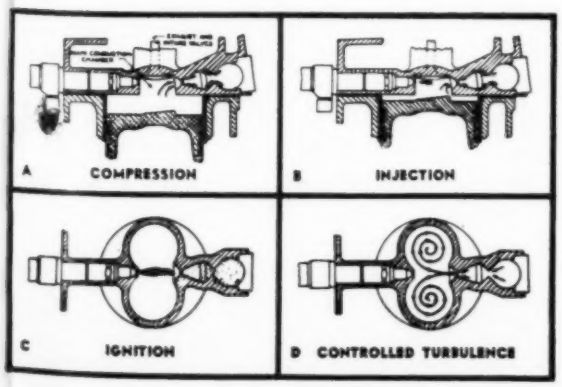
The Buda-Lanova Diesel engine has what is known as soft combustion. The rate of pressure rise is well within the limits of gasoline engine practice. They have maximum pressure not over 700 pounds per square inch which is conservative practice today. The compression ratio is somewhat lower than the average high speed Diesel engine, therefore the ratio of compression is more comparable to modern gasoline engines.

The Buda-Lanova has a high "workable" mean effective pressure due to the excellently organized and controlled turbulence for combustion. High mean effective pressure is not attained by high combustion pressure as is sometimes the case. Therefore, the advantage of high mean effective pressure is obtained with low maximum combustion pressures.

Buda-Lanova Diesels, due to their inherent design, start easily in cold weather.

The group of engines illustrated at the right typifies the completeness of the line of Diesel engines offered by the Buda Company for truck and bus service. The 6-cylinder unit at the top and the 4-cylinder unit at the bottom are known as the Model DT type and are built in two cylinder sizes – the Model 4-DT-196 in $3\frac{5}{8}$" x $4\frac{3}{4}$" and the Model 4-DT-212 in $3\frac{5}{8}$" x $5\frac{1}{8}$". The 6-cylinder engine in the middle is the Model 6-LD-691 with a bore of $4\frac{3}{4}$ in. and a stroke of $6\frac{1}{2}$ in. In each case the end figures of each model refer to the cubic inch displacement.

Ignition on all Buda-Lanova Diesels is by compression, no auxiliary equipment being necessary. Strictly automotive engines in all details, they have 3 point suspension, a full circulation pressure system to all crankshaft bearings, connecting rod bearings, valve rocker arms, and timing gears. A wet sump system is used.



Oil pressure is regulated by a spring loaded bypass valve – 30-40 lbs. normal pressure, dependent upon speed.

The crankcase and cylinder castings are in one piece of chrome nickel iron, carefully ribbed to insure rigidity and permanent alignment of crankshaft bearings and cylinder sleeves. Cylinder liners are of the removable dry sleeve type. Easily removed or replaced in the field. Material – alloy cast iron, ground finish.

Pistons are aluminum alloy, length $4\frac{15}{16}$ in., equipped with five rings. The piston pin diameter is $1\frac{1}{4}$ in. and total length of bearing is $2\frac{49}{64}$ in. of the full floating type.

HOW THE BUDA-LANOVA "CONTROLLED TURBULENCE"* COMBUSTION SYSTEM OPERATES:

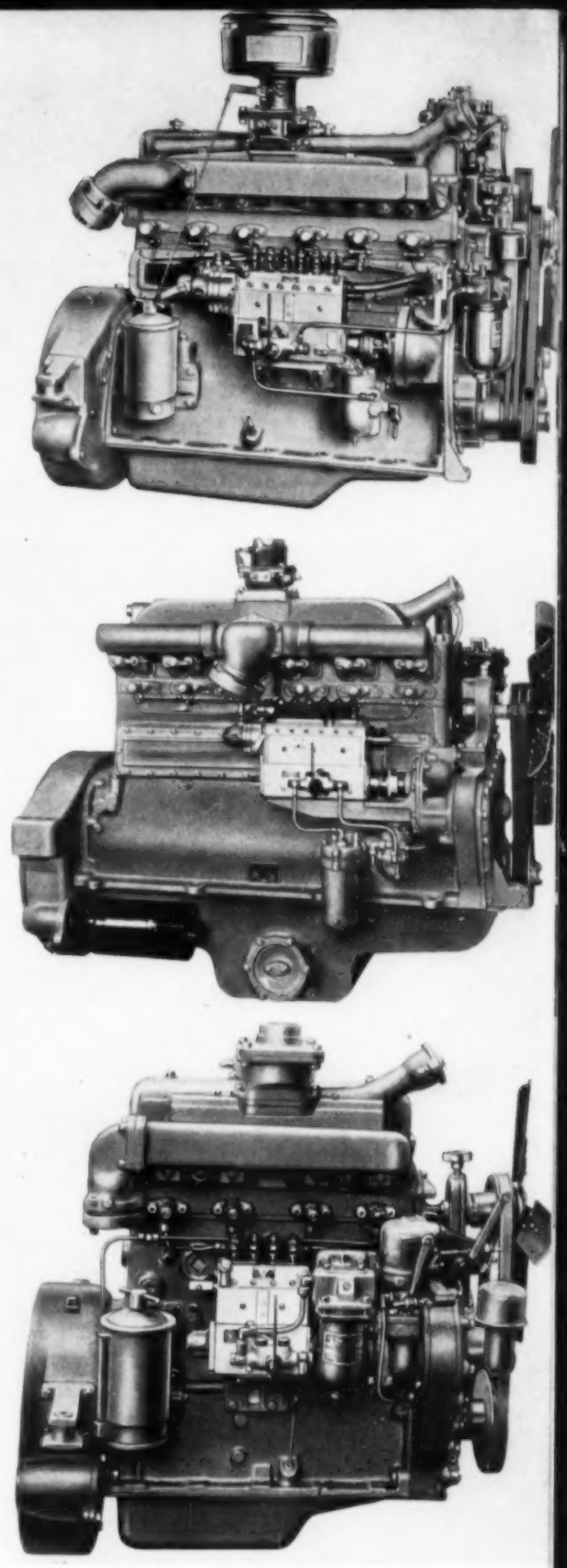
(*A*) *Compression Period* – During the compression stroke, air is squeezed or compressed into the main combustion chamber which lies under the intake and exhaust valves. This chamber is figure "8" shaped. A predetermined portion of air is also forced back into the minor and major energy cells, as indicated by the arrows.

(*B*) *Injection Period* – Just before the piston reaches top dead center, while air is being forced at high velocity through the opening leading into the energy cell – the injection of fuel begins. The spray passes through the heated air of the main combustion chamber (note that no fuel strikes the piston) and predetermined portion of fuel also enters the energy cell with this inrushing air, where it is intimately mixed with this air.

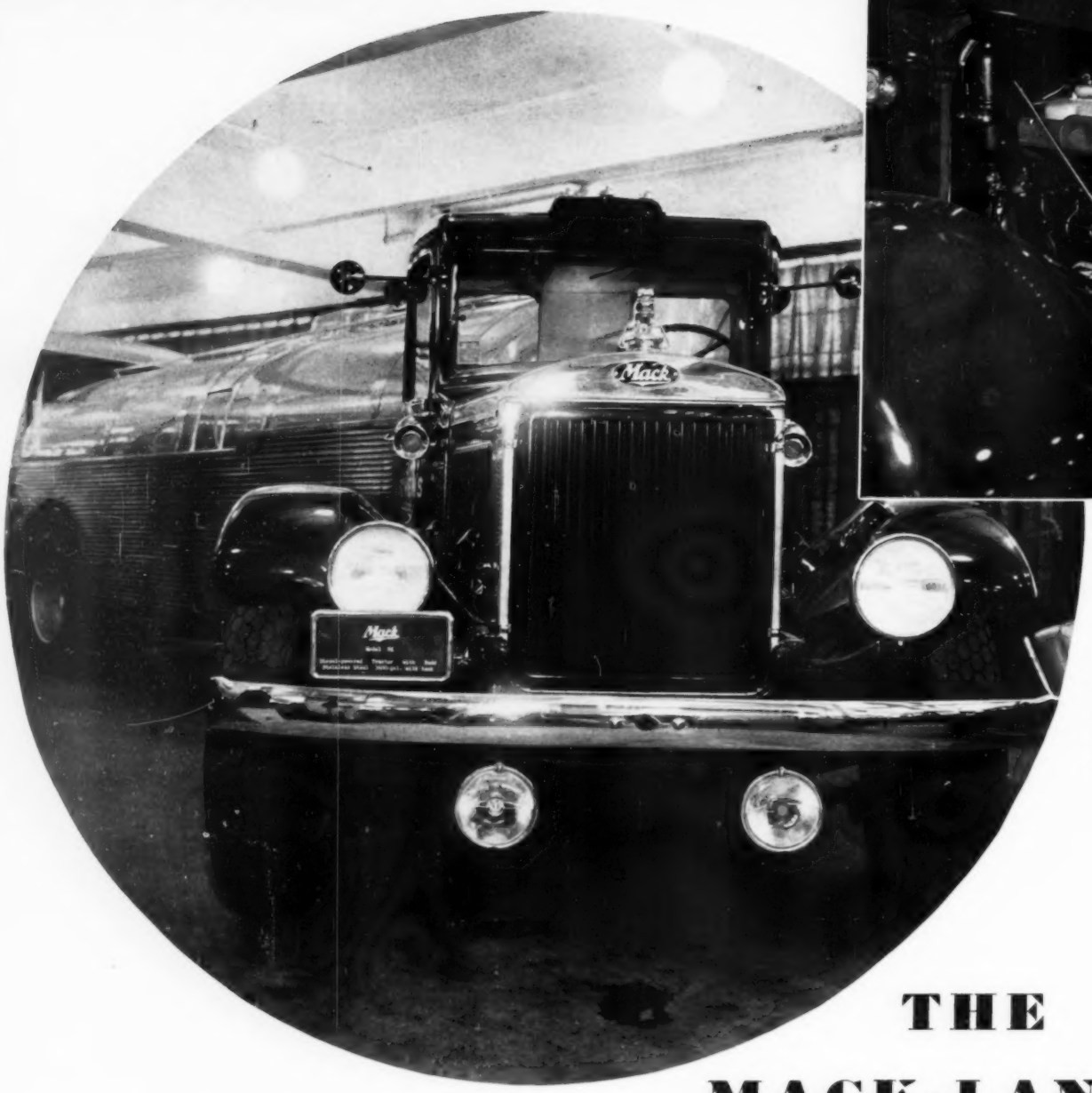
(*C*) *Ignition Period* – Initial ignition takes place in the main combustion chamber where the compression, and consequently the temperature, is slightly higher. The fuel mixture burns very slowly here, as it is not yet thoroughly mixed with the air. This delayed burning eliminates sudden explosion of the fuel and possible shock to piston, rod, bearings, etc. – an important feature.

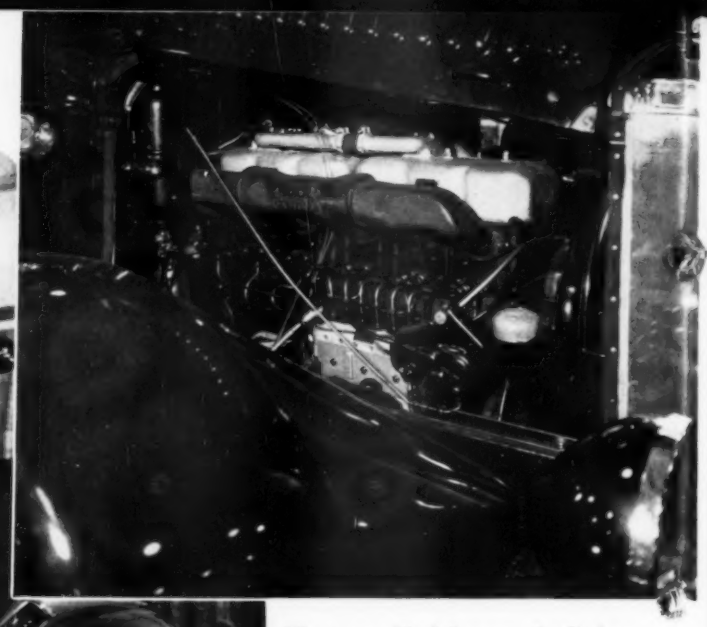
(*D*) *Controlled Turbulence Period* – In the energy cell, where the fuel is well mixed with air, the burning is rapid. High pressure is developed quickly, and a blast or back-fire is sent out across the main combustion chamber toward the nozzle. This blast breaks up the cloud of fuel in front of the cell and starts the "double swirl" in the main combustion chamber. This violent swirling, called turbulence, thoroughly mixes the fuel with the air in the main chamber and results in complete combustion and low fuel consumption.

*This system of combustion is called "Controlled Turbulence" because the size of the energy cell controls the amount of fuel and air taken into it. The size of the venturi shaped mouth of the cell controls the duration of blast. These two regulate the amount and duration of turbulence. Thus, "Controlled Turbulence." The system is patented.



Top–Model 6-DT-278 Buda-Lanova Diesel for truck and bus application. Middle–Model 6-LD-691 Buda-Lanova truck and bus engine. Bottom–Model 4-DT-212 which is the Ford conversion unit.





The new Mack-Lanova 6-cylinder Diesel engine installed in Mack truck illustrated at left.

Model BX Tractor with the new Mack ED Diesel engine, hauling a Budd semi-trailer, with a Standard Steel 3,600 gal. milk tank unit, to be placed in operation by Dairymen's League of New York.

THE MACK-LANOVA DIESEL ENGINE

By B. J. VON BONGART

MACK is one of the first American truck or bus manufacturers to build its own Diesel engine. The culmination of years of extensive development, the Mack-Lanova Diesel is now in production, and was exhibited in New York at the National Truck Show. Intended for use in both trucks and buses, it is built completely in Mack factories, accessories excepted.

For the past eight years, Mack has carefully observed developments in the Diesel field. Hundreds of Mack trucks have been equipped with the leading American and European Diesel engines. Lessons learned in testing and servicing these engines in every type of service throughout the world stimulated and determined the final design of Mack's own engine. It was not until this engine had proved itself to the utmost, and until tooling and production technique had been thoroughly worked out, that announcement of the Mack-Lanova Diesel engine was made to the public.

At present, the engine is available in one size. A 6-cylinder four-stroke cycle engine of 4⅜ inch bore and 5¾ inch stroke, hence of a piston displacement of 519 cu. in. and developing 131 hp. at but 2,000 rpm. The maximum torque is 381 ft. lbs. and the b.m.e.p. is 110 lbs.

As its name implies, the Mack Diesel engine employs the Lanova energy-cell combustion system. It was selected because it provides high power per cubic inch with minimum peak pressures, bearing loads, fuel pressure and compression. Other advantages of this combustion system are smoothness, responsiveness and flexibility, ability to idle well and low fuel consumption.

The combustion chamber in each cylinder, of characteristic Lanova form, is of figure 8-shape; valves opening into the two lobes between which there is a narrow throat. The injection nozzle, of the Bosch pintle type, is located on one side of this throat and is positioned to direct a narrow spray directly across the throat toward the venturi of the energy cell. The latter is positioned directly opposite the nozzle and comprises two small cells in tandem and in turn connected by a venturi choke. As to combustion, chamber lobes constitute practically all of the clearance volume—excepting the relatively small proportion imprisoned within the tandem energy-cells—the bottom surface of the cylinder head has only gasket clearance over the

piston. The control of combustion is the chief advantage of this system, which is provided by the relative volumes of the two cells and the carefully developed sizes of the venturis between them.

The principle operates so effectively that Mack-Lanova Diesel engines have peak pressures only slightly higher than those of gasoline engines, and the more sustained combustion results in "corpulent" indicator diagrams resulting in exceptionally high b.m.e. pressure, the ultimate goal of all Diesel engine technicians.

The cylinder block and crankcase of the Mack-Lanova Diesel are cast integral for strength and rigidity. The cylinder heads are not cast en-bloc but rather in two separate castings of three heads each.

The crankshaft is counterbalanced with twelve counter weights forged integral and is suspended in seven bearings. It is a stiff shaft, with main bearings 3½ inch diameter and with crankpins of 3-inch diameter.

The pistons are of almuninum alloy with internal ribs but of T-slot camground form. The large piston pin is of the full-floating type retained by telescoping aluminum buttons with spherical segment ends ground to the same arc as the cylinder bore.

The fuel injection system consists of American Bosch pumps and pintle type nozzles. The pump is of the latest flange-mounted type and is driven by a self-aligning coupling enclosed within the housing. As it is correctly timed at the factory, it is tamper-proof against garage mechanics and drivers. The Pierce governor on the same shaft prevents overspeeding.

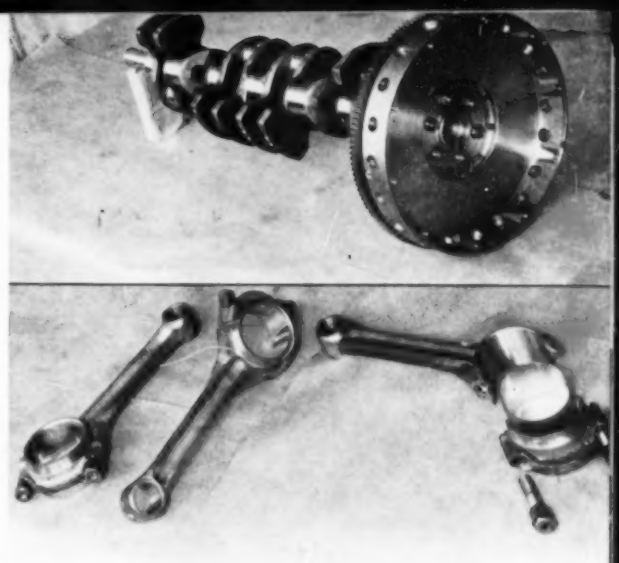
A Bosch transfer pump supplies fuel to the injection pump, there being one filter ahead of the transfer pump and two filters between the latter and the injection pump. These extensive precautions assure the delivery of grit-free fuel, and thus prevent the clogging of the injection nozzles.

As in all Mack engines, particular emphasis has been placed upon temperature control and especially on this engine in view of its importance on Diesels. Directed water flow is provided to secure uniformity of temperature throughout the cylinder block. The incoming water is directed upward into the cylinder heads adjacent to the exhaust valve seats, a portion of the incoming water is forced downwards into the cylinder jackets from whence it rises to the head through separate passages. Thus, the water is distributed evenly throughout the cylinder block and heads, and the activity of the flow and the quantity of the water is graduated in proportion to the amount of heat absorbed.

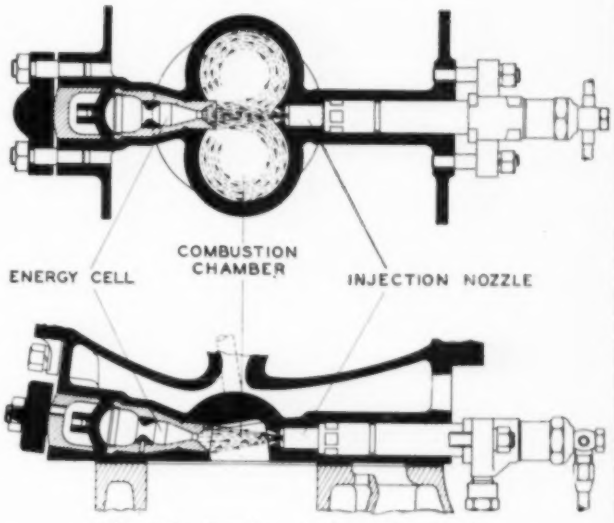
To maintain water temperature within the efficient operating range, thermostatic control of water flow is utilized on the distinct Mack cooled-circulating principle. The elements of this system are thermostatic valves comprising two ether-bellows thermostats in parallel. Twin thermostats give a margin of safety over single units, and, small thermostats have been found longer lived and more dependable than large ones.

The operation of the Mack thermostat control is unorthodox. In the usual design (assuming that the engine is started cold), the cold water circulates within the engine thus keeping the engine cold for a long period, and the radiator is by-passed so that the water within it cannot circulate and is thus readily subject to freezing. In the Mack system, the themostats permit the water to circulate within the radiator at all times, but the jacket water is not circulated unil the engine has warmed up.

The crankcase of the Mack-Lanova Diesel engine is ventilated, fresh air is taken in through a filtered-type breather cap. The gaseous vapors of the crankcase are disposed through the exhaust and the intake of excess oil vapor is stopped by the air filter at the intake manifold.

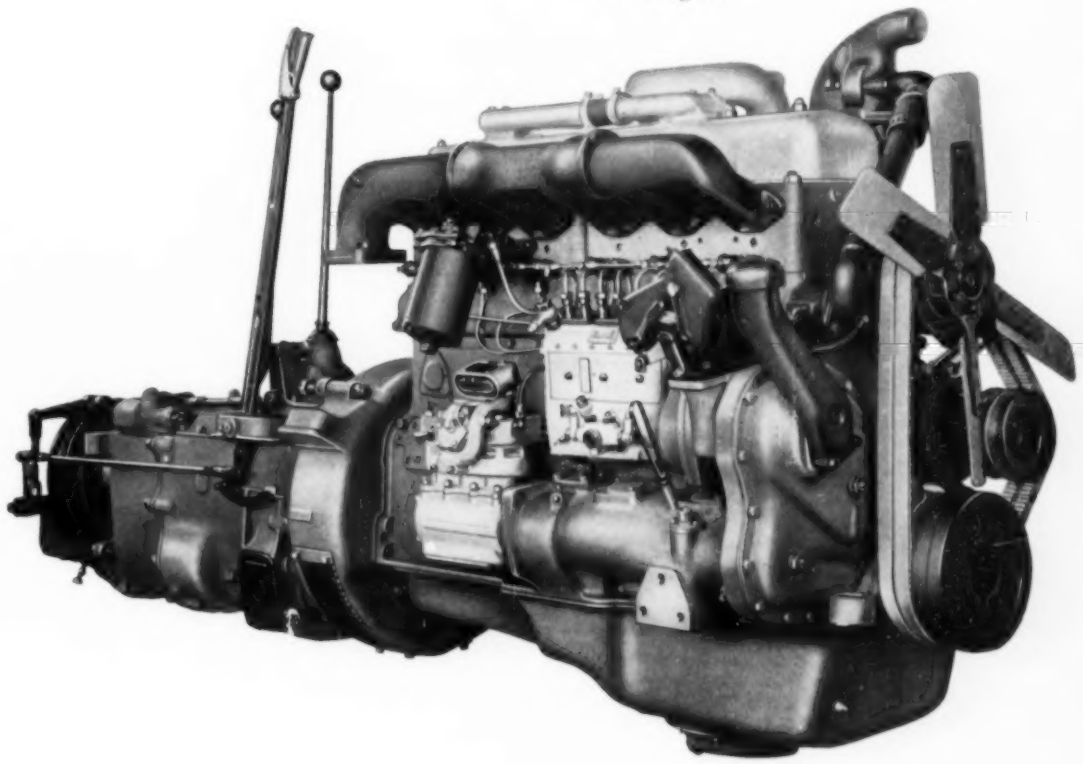


Crankshaft and connecting rod assemblies of the new Mack-Lanova Diesel engine.



Schematic drawing of how the Mack-Lanova combustion system works.

The fuel pump side of the new Mack-Lanova 6-cylinder 131 hp. 519 cu. in. Diesel engine.



LANOVA

"THE HEART OF THE ENGINE"

HERE ARE 10 EXCLUSIVE ADVANTAGES OF BUDA LANOVA DIESELS

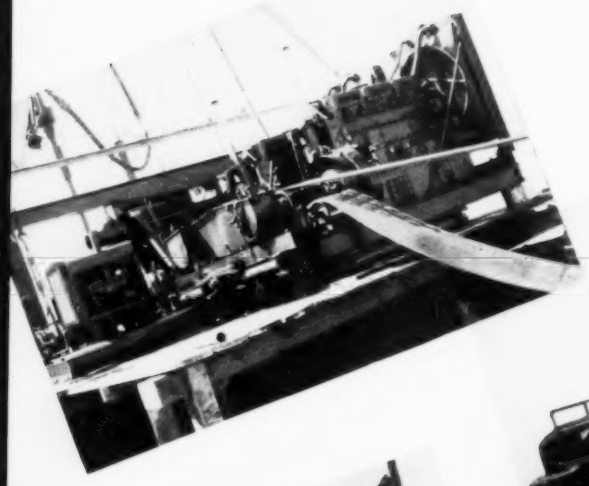
1. Lower Compression Ratios
2. Lower Maximum Cylinder Pressures
3. Higher Mean Effective Pressures
4. Lower Specific Weight
5. Lower Rate of Pressure Rise
6. Lower Exhaust Temperatures
7. Lower Piston Temperatures
8. Smoother Operation
9. Cleaner Combustion
10. Excellent Fuel Performance

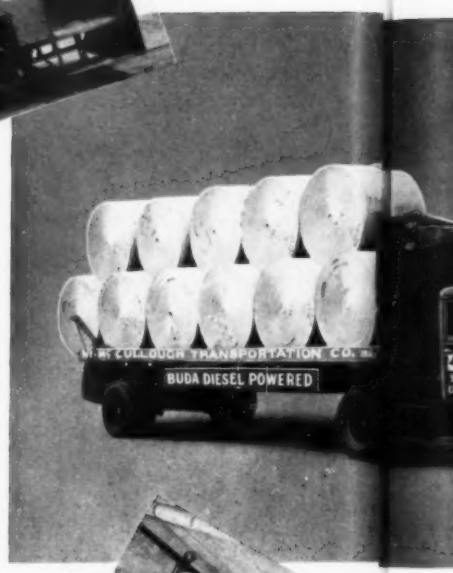
Buda-Lanova 4 cycle Diesel engines are built in a wide range of sizes—20 hp. to 220 hp.

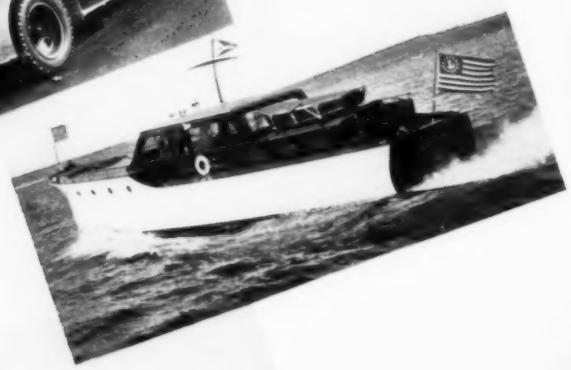
DIESEL BU LANOV

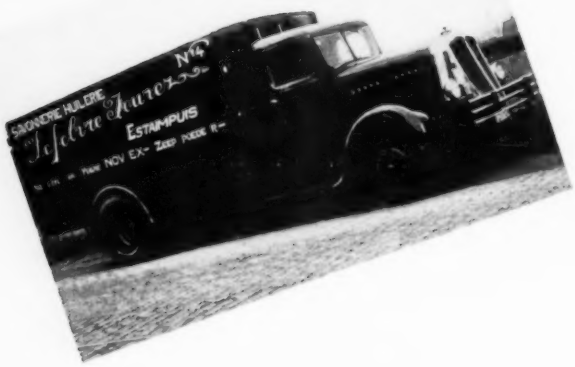
The Answer to Industry's Deman

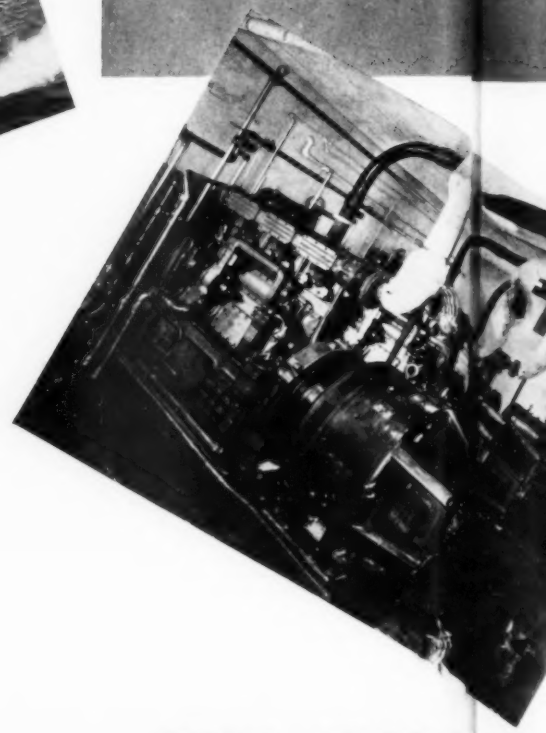
POW











THE BUDA C

HARVEY • I

AMERICA'S MOST COMPLETE LINE OF HIGH SPEED DIESELS WI'H A

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Demand for Efficient and Economic

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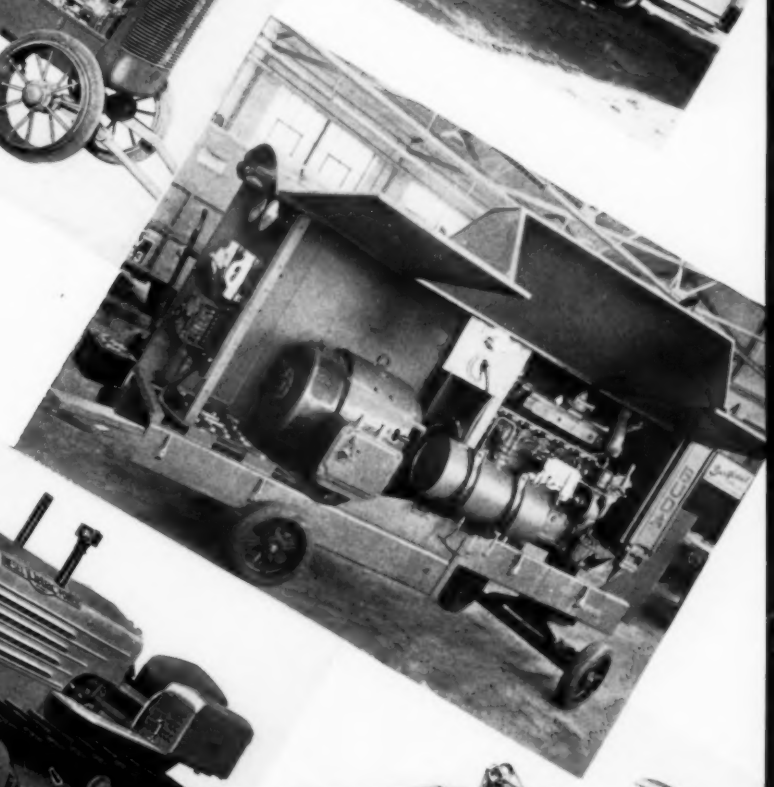
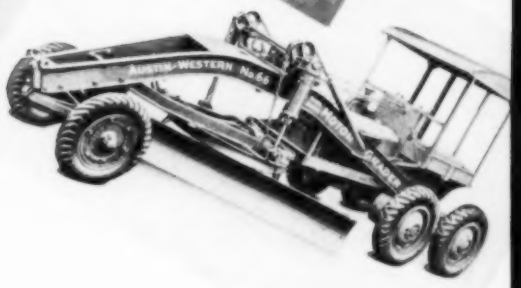




UDA COMPANY
ARVEY • ILL.

WITH ALL THE ADVANTAGES OF THE LANOVA COMBUSTION SYSTEM

BUDA LANOVA

DIESEL ENGINES ARE SERVING ON

AUTOMOTIVE SERVICE:
- Trucks and Buses

MARINE SERVICE:
- Pleasure Boats
- Work Boats
- Ferry Boats
- Fishing Boats
- Pilot Boats

STATIONARY INDUSTRIAL SERVICE:
- Generators
- Compressors

OIL FIELD SERVICE:
- Drilling
- Hoisting
- Production Pumping
- Pipe Line Pumping
- Repressuring
- Lighting Plants

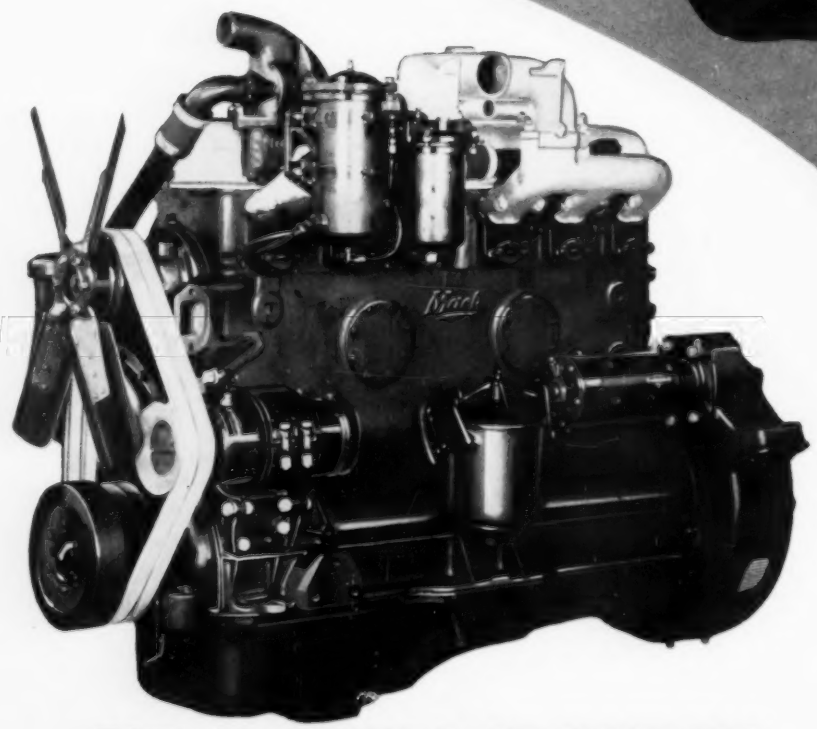
PORTABLE INDUSTRIAL SERVICE:
- Shovels
- Draglines
- Locomotives
- Compressors
- Concrete Mixers
- Tractors
- Road Rollers
- Dredges
- Well Drills
- Ice Machines
- Feed Mills
- Rock Crushers
- Cranes
- Hoists
- Rail Cars
- Pavers
- Asphalt Plants
- Road Graders
- Snow Plows
- Pumps
- Arc Welders
- Saw Mills
- Hammer Mills

LANOVA
"THE HEART OF THE ENGINE"

MACK PRESENTS

Climax to eight years of intensive research on Diesel power, Mack presents a full range of Diesel trucks • Here, Diesel is developed into the most economical truck power available today — slashing as much as one third from former fuel costs. Coupled with famous Mack stamina and dependability, it provides the biggest truck value ever offered • Eight distinct Diesel engines give Mack the most complete line of Diesel-powered trucks in America! . . . all embodying the patented Lanova principle of "controlled combustion." You owe it to your business to find out about these sensational new Mack Diesels right away!

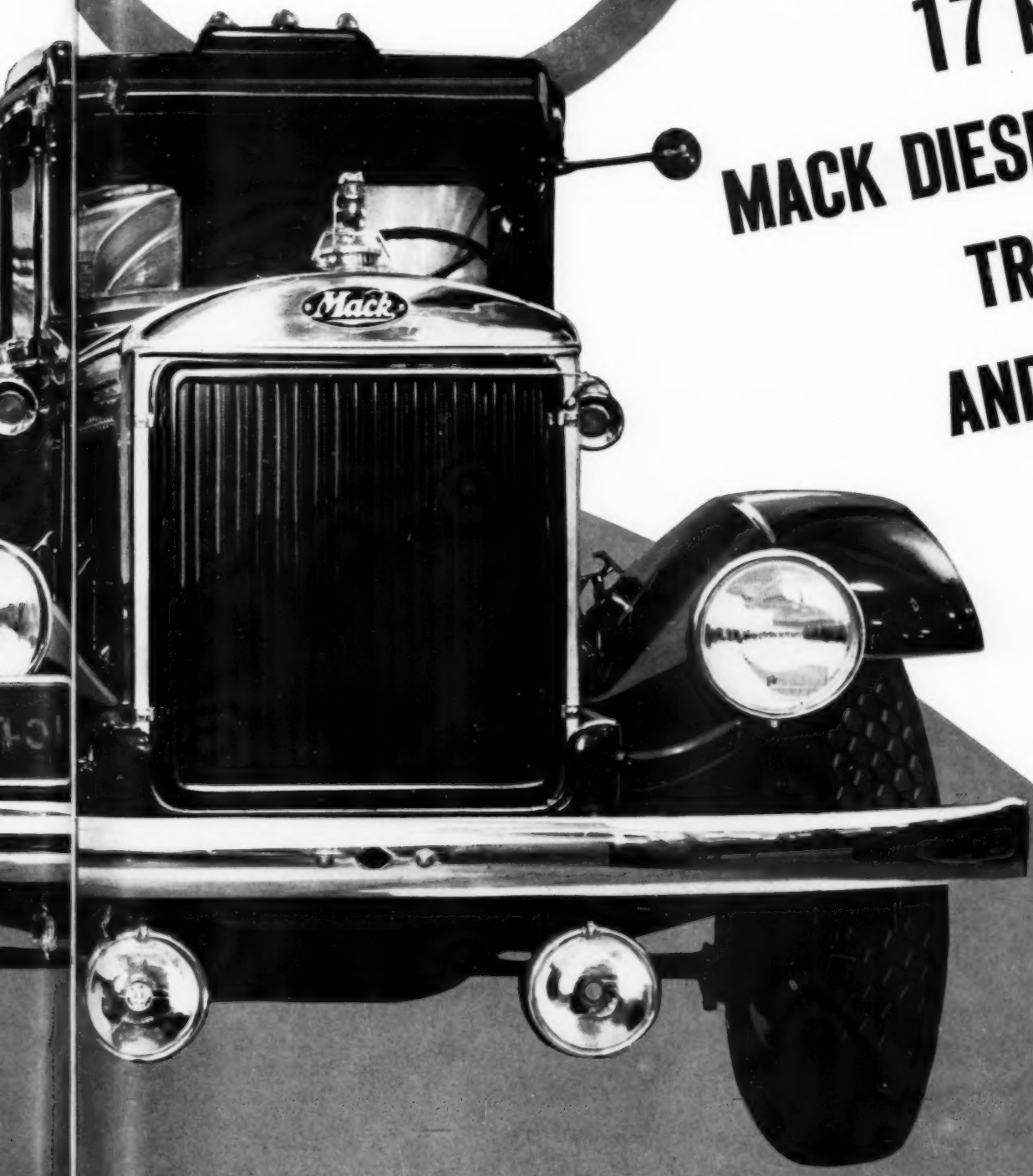
WRITE TODAY FOR FREE ILLUSTRATED FOLDER! MACK TRUCKS, INC., NEW YORK, N. Y.



FOR ALL KINDS OF HAULING
. . . IT'S A Mack

DIESEL POWER!

17 NEW MACK DIESEL POWERED TRUCKS AND BUSES



LANOVA

"THE HEART OF THE ENGINE"

Mack-Lanova Diesel Engines provide rock-bottom fuel economy and high power per cubic inch displacement. The figure-8 combustion chamber—sturdy "Heart of the Engine"—means smooth, responsive, flexible performance at all times.

LANOVA

"THE HEART OF THE ENGINE"

LANOVA

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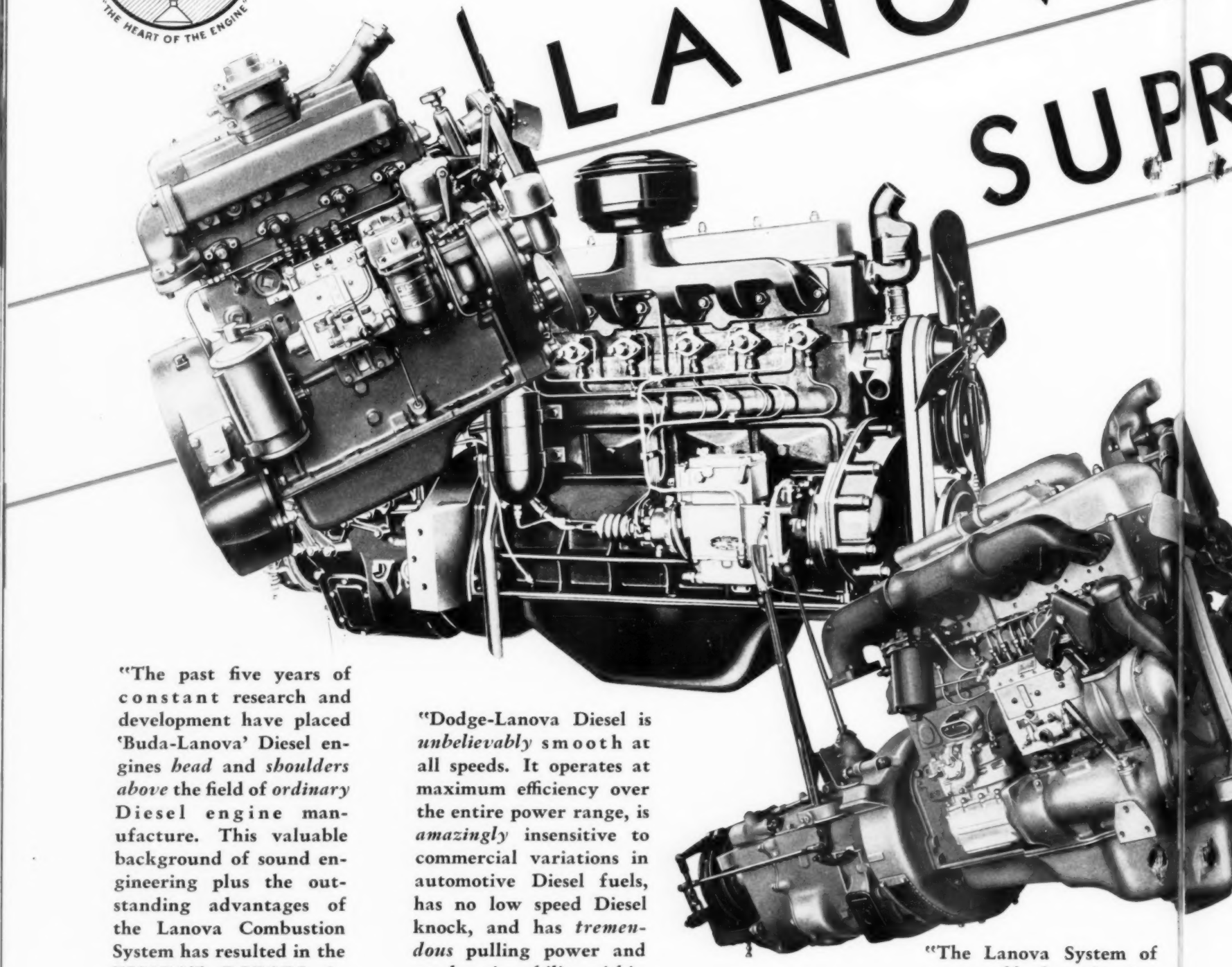


"The past five years of constant research and development have placed 'Buda-Lanova' Diesel engines *head* and *shoulders above* the field of *ordinary* Diesel engine manufacture. This valuable background of sound engineering plus the outstanding advantages of the Lanova Combustion System has resulted in the FINEST DIESEL in America today."

—BUDA

"Dodge-Lanova Diesel is *unbelievably* smooth at all speeds. It operates at maximum efficiency over the entire power range, is *amazingly* insensitive to commercial variations in automotive Diesel fuels, has no low speed Diesel knock, and has *tremendous* pulling power and accelerating ability within the full range."

—DODGE

"The Lanova System of controlled combustion represents the *highest development* of Diesels today. The Lanova energy cell combustion system *has been selected after exhaustive tests of all other successful systems* because it provides the highest practicable power per cubic inch with the minimum peak pressures, bearing loads, fuel pressure and compression."

—MACK

LANOVA CORPORATION

27-01 BRIDGE PLAZA

LONG ISLAND CITY, N. Y.

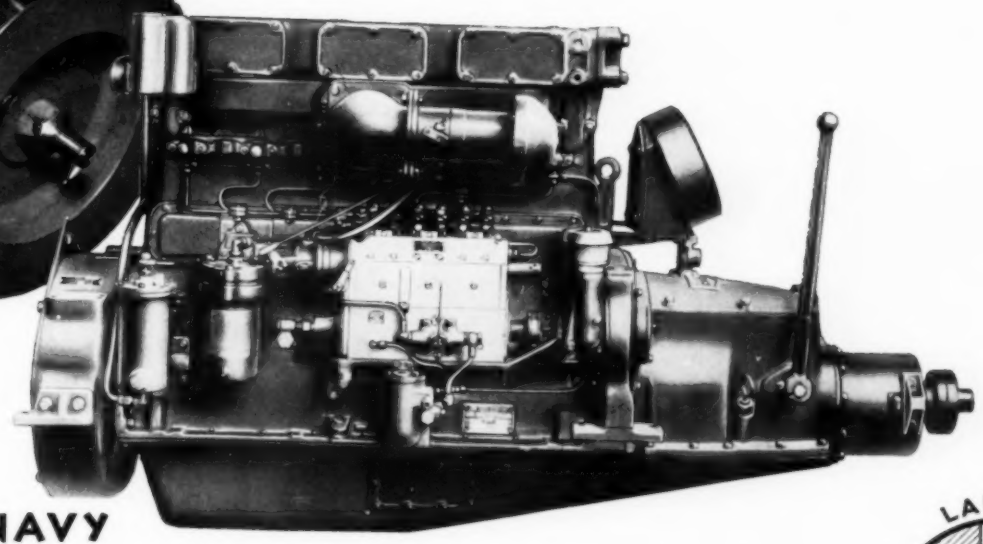
A.

SUPREMACY

Endorsed

"Thornburg - Lanova Diesel engines use the famous Lanova principle of combustion. The new Thornburg adaption of the Lanova System gives performance in these small engines equaled before only in large air-injection Diesels. The result is *SUPERIOR* PERFORMANCE— GREATER EFFICIENCY — DEPENDABILITY — LOW FIRST COST."

—THORNBURG



—U. S. NAVY

Nuf said!

LANOVA

"THE HEART OF THE ENGINE"

NEW DODGE 3-TON

WITH A DODGE-DESIGNED, DODGE-BUILT DIESEL ENGINE...*FLEXIBLE* AS A GASOLINE-POWERED TRUCK... WITH MILES-PER-GALLON INCREASE OF 40% OR MORE

THIS new Dodge Diesel Truck is the achievement of more than a decade of intensive development by Dodge engineers to give you true full-diesel economy in a truck as flexible and easy to handle as a gasoline-powered vehicle. It is unbelievably smooth at all speeds, and operates at maximum efficiency over the entire power range. Amazingly insensitive to commercial variations in automotive diesel fuels. Exhaust is otably smoke-free with all specified fuels under all load and speed conditions. No low-speed "diesel knock." Tremendous pulling power and accelerating ability within the full range of its governed speed. "Truck-built" construction throughout. Tough extra-strength 7-bearing crankshaft, induction hardened, with vibration dampener. Large replaceable type copper-lead main and connecting rod bearings. Aluminum alloy pistons, precision fitted. Full-length water jackets. 24-volt electrical system. Five-speed transmission completely roller and ball-bearing mounted. Roller-bearing universals. "Truck-built" full hydraulic brakes. Springs and axle shafts of tough Amola Steel. And many other extra-value advantages to insure expense-saving dependability and long life.

AMAZING ECONOMY

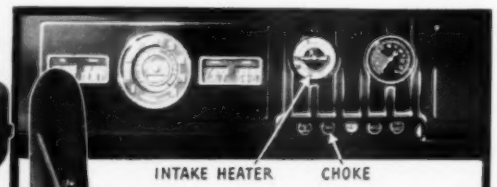
Idles Perfectly on 1/12 Drop of Fuel per Explosion

Scientific combustion chamber design achieves high turbulence and thorough, smoke-free combustion, even at idling speeds. At least 40% better fuel economy per gallon than a gasoline engine of full load size under the same working conditions.

SELF-CLEANING PINTLE-TYPE NOZZLES

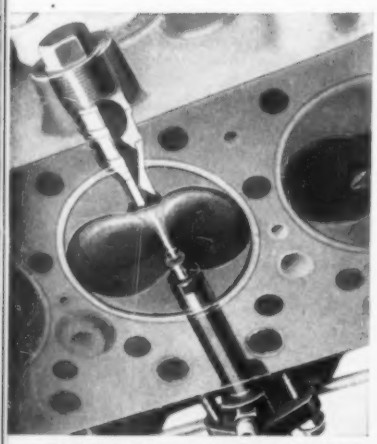
Positive mechanical cleaning by a metal plunger during operation prevents clogging, helps maintain a steady flow of power, saves maintenance expense.

TWO-STAGE FUEL FILTRATION
Greatest insurance possible against fuel injection troubles.

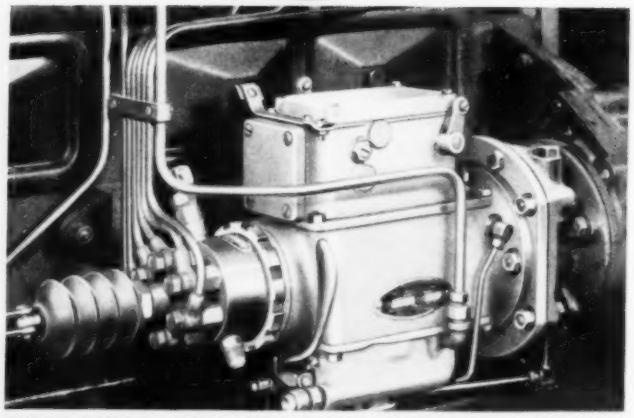


EASY ZERO-MORNING STARTING

Proved in cold-room tests and in actual service in zero weather! Electric intake air heater, manually set according to temperature, eliminates need for external heating of manifold in zero weather. 24-volt electrical system insures satisfactory cranking speed. Choke on dash increases fuel injection during starting only.



CONTROLLED COMBUSTION Makes it remarkably SMOOTH. The Dodge Energy-Cell discharges into the cylinder at the correct rate to give a smooth, even flow of power throughout each power stroke. Peak combustion pressures do not greatly exceed those in a gasoline engine.



FIRST DIESEL WITH AUTOMATIC INJECTION ADVANCE ***to meet automotive performance needs at all speeds within its governed range.*** An entirely new type of fuel injection pump with automatic built-in mechanical governing of idling, maximum speed, and injection advance. Maximum fuel quantity automatically controlled for every speed. Simplified design, only one metering valve. Accessible idling adjustment. Automatic lubrication from engine crankcase.

AN AUTOMOTIVE DIESEL ENGINE IS DIFFERENT!

The Dodge Diesel Truck Engine departs from conventional slow-speed diesel design in many ways, to give flexible, smooth power right up to its top governed speed of 2600 r. p. m. Its cylinder, crankshaft assembly, and valve construction are similar to a gasoline engine, making it readily understandable to the average truck maintenance man. It employs an energy-cell type of combustion chamber which keeps combustion pressures down to a point not greatly exceeding that in a gasoline engine, even though compression ratio is 14.5 to 1. It overcomes the smoke nuisance. And it introduces automatically advanced injection timing which is almost as important to full-range efficiency in a diesel engine as is the automatic spark advance in a gasoline engine.

N DIESEL TRUCKS

6 CYLINDER 4-CYCLE

Take a Test! ... THAT'S ALL DODGE ASKS!

REMARKABLE PERFORMANCE AND HANDLING EASE

No Smoke Nuisance—No Low-Speed "Diesel Knock!"

FOUR 3-ton Chassis, 152", 170", 188", and 205" wheelbase lengths. Roomy, luxurious cabs. Modern Dodge streamlined styling. Dependable Dodge Truck construction throughout, and all these advanced automotive diesel engine features:

AUTOMATIC INJECTION ADVANCE. First truck diesel engine with injection timed according to engine speed. Maximum fuel economy at any speed.

SIMPLIFIED INJECTION PUMP. Six plungers arranged in a circle. No crankshaft. Only one relief valve. Less parts.

ANTI-CLOGGING NOZZLE. Pressure-controlled pintle cleans nozzle after each injection. No dribbling.

EASIER COLD STARTING. Choke controlled by pull-out lever on dash. Automatically stops choking when engine runs. By-pass thermostat in cooling system insures quick warm-up.

SMOKE-FREE OPERATION. Notably smoke-free over entire power range. Distinctive Dodge advantage that overcomes a common objection to diesels.

SUCCESSFULLY BURNS ANY AUTOMOTIVE DIESEL FUEL *within a wide specified range*

SMOOTH IDLE. Automatic governor with readily-accessible idle speed adjustment. Vibration dampener on crankshaft contributes to engine smoothness at all speeds.

"ENERGY-CELL" CONTROLLED COMBUSTION. High-turbulence means of thoroughly mixing fuel and air for more uniform, complete combustion. Assures smoother power, with excellent fuel economy.

DOUBLE-O COMBUSTION CHAMBER. Concentrates main mass of air at center of chamber where fuel is injected. Insures most effective combustion control.

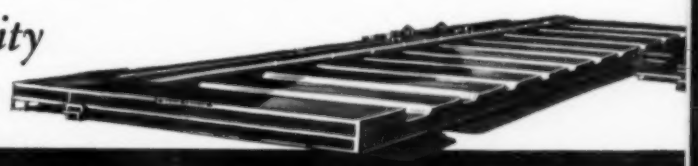
LONG VALVE LIFE due to lower exhaust-gas temperatures achieved by Dodge controlled-combustion principle. Hardened steel valve seat inserts in exhaust valve ports insure long-lasting compression seal, greatly postpone the need for valve grinding.

RELIABLE 4-CYCLE PRINCIPLE. Lower piston operating temperatures. Simplified cooling. Dependability and lasting efficiency of Dodge construction proved by test.

Simple to Operate as any Gasoline Truck. Take a Test of the new Dodge Diesel Truck with Dodge-Built Diesel Engine—that's all Dodge asks.

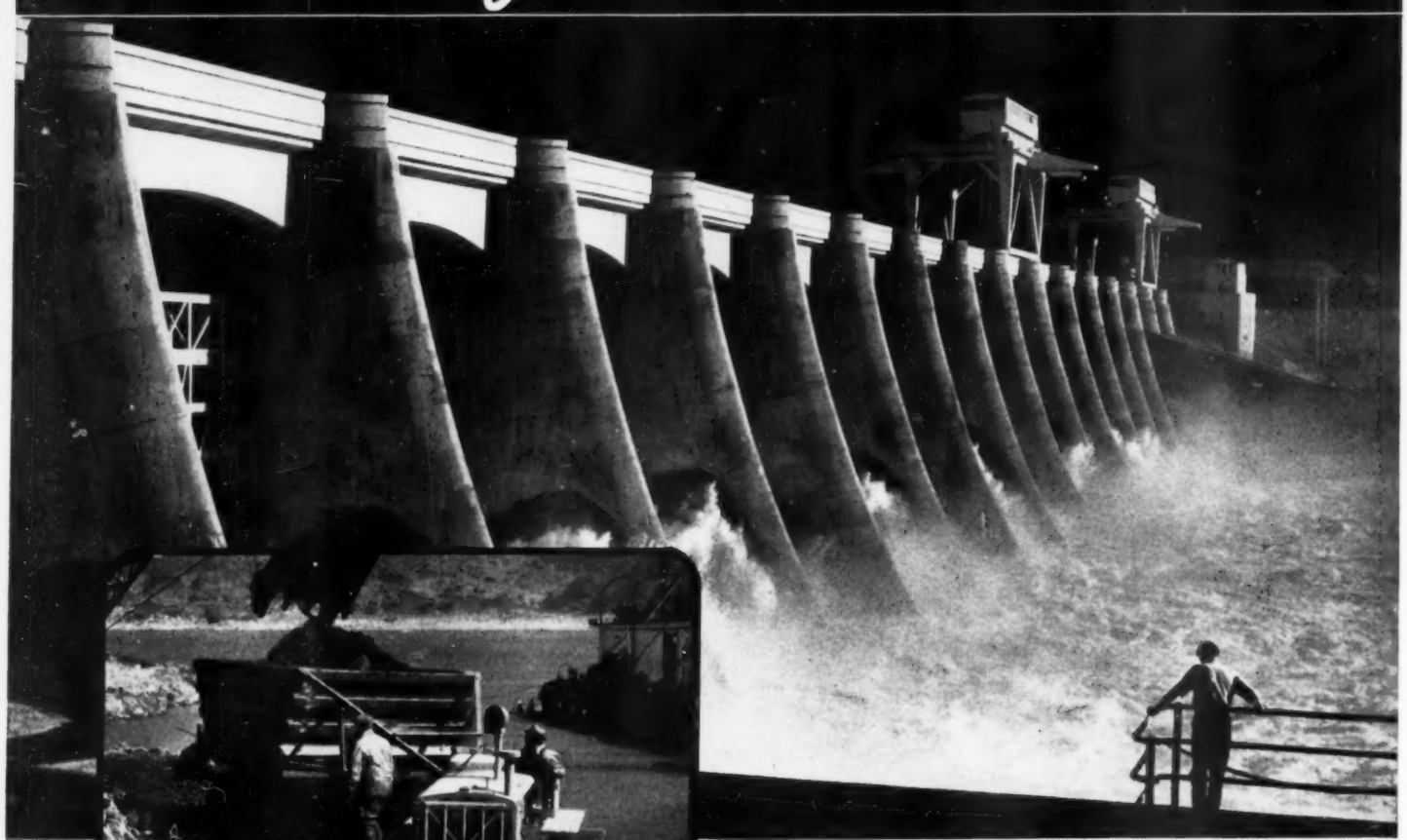
DODGE—*Division of Chrysler Corporation, Detroit, Michigan*

DODGE FIRST TO GIVE YOU *Proved Dependability and all these Advanced Performance Advantages*



"TRUCK-BUILT" IN GIANT NEW DODGE TRUCK PLANT!

Harnessing THE COLUMBIA RIVER



Built in 4 years and 2 months at a cost of $75,000,000, this gigantic Bonneville dam on the Columbia River boasts the world's largest single lift shiplock for ocean-going vessels, has a spillway dam 1250 feet long, 180 feet wide at its base. Helping to move six million yards of dirt and rock was an important part that "RPM" Diesel Engine Lubricating Oil played in this outstanding engineering feat.

A REMARKABLE PROJECT needed a superior oil! And so—"RPM" Diesel Engine Lubricating Oil went to work! This world-famous lubricant was chosen for the "Caterpillar" Diesel tractors and compressor engines on the great Bonneville dam project.

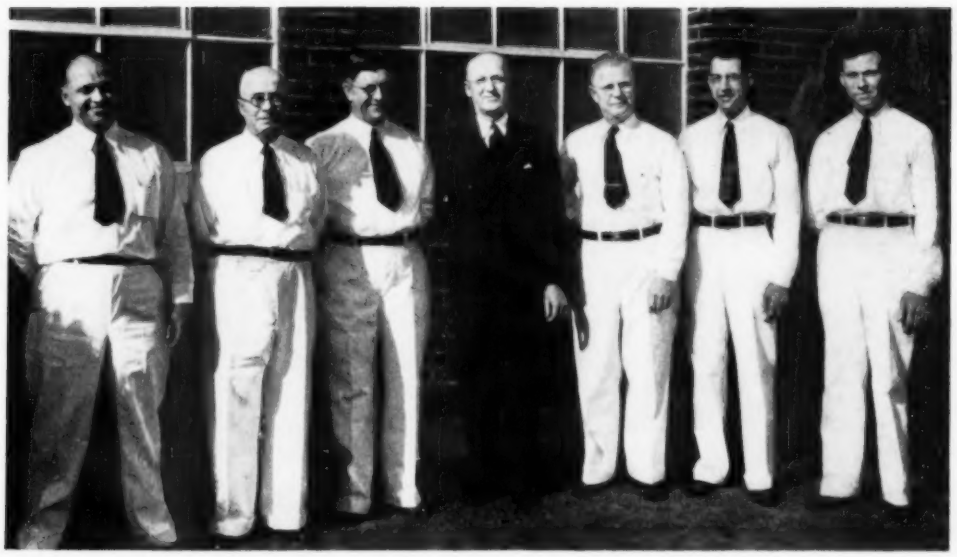
And no wonder! It keeps operating costs down—eliminates ring-sticking—reduces overhauls for carbon removal. That's why "Caterpillar" Diesel Engine operators everywhere depend on "RPM" Diesel Engine Lubricating Oil.

Make it the oil for *your* "Caterpillar" Diesel equipment. It not only maintains low oil consumption but holds engine wear to a minimum. You'll find out why "RPM" Diesel Engine Lubricating Oil is the world's *first choice* for "Caterpillar" Diesel lubrication.

RPM
REG. TRADE MARK
DIESEL ENGINE LUBRICATING OIL

Approved by
CATERPILLAR TRACTOR CO.

STANDARD OIL COMPANY OF CALIFORNIA



The men who operate the highly successfully McMinnville Diesel Power Plant. Reading from left to right: George Wagner, Wesley Vaughn, Sherman Lange, M. H. McGuire (General Manager), F. J. Reynolds (Chief Engineer), Elmer Davenport, and Paul Jones.

A NEW ENGINE FOR McMINNVILLE, ORE.

(*Continued from page* 28)

Busch-Sulzer special mufflers are fitted below the ground level. All piping for fuel, lube and water, as well as electric trunk lines, are carried beneath the floor of the main building. Externally the plant is most attractive and free from obstructions. The 1,800 hp. engine is quieter than either of the old 300 hp. engines which were removed.

The McMinnville system has shown a constant average annual increase in kilowatt output of from 10 to 15 per cent per year. In 1937 the system produced 5,677,056 kilowatts. The peak demand is about 2,000 kilowatts. It has 50 miles of rural lines and 1,723 customers. The valuation, as of January 1, 1938, was $295,108 and the new 1,800 hp. setup cost almost exactly $110,000.

Not a single tax has ever been levied for the municipal light and power station at McMinnville. Revenues absorb interest and amortization of the revenue bonds, and the new installation was built from cash surplus from both the Light and Water Divisions of the Municipal Utilities department.

Manager McGuire was widely acclaimed at the time of dedication of the new unit, by officials of State, Municipal, County, and Civic organizations, as well as business men. A fitting tribute to his 19 years of work building up a plant that has a capacity of 1.1 kilowatts for each citizen, as against a national average of one-third killowatt. It proves the consumers think well of McMinnville Municipal power.

Notice to Diesel Engine Manufacturers

SEALED bids, addressed to the City Commission of the City of Bryan, Texas, for furnishing one 1,000 hp. Diesel engine complete with generator, exciter, and all auxiliary appurtenances, F.O.B., Bryan, Texas, will be received by the undersigned up to 7:30 o'clock, P.M., December 16, 1938.

Bids shall be submitted on Manufacturers' Standard contract and proposal forms and shall be accompanied by detailed specifications, including all special features mentioned and special information requested in the questionnaire regarding performance and specifications covering generator and exciter, as furnished by the City of Bryan.

Bidders must submit cashier's check or bidder's bond for five per cent (5%) of the total bid, payable without recourse to E. E. Yeager, Mayor, as a guarantee the bidder will enter into the contract and execute bond satisfactory to the City Commission for the full amount of the contract within ten (10) days after notice of award of contract.

The City of Bryan will expect to pay for the equipment purchased on the basis of ten thousand dollars ($10,000) cash, and the balance in interest-bearing revenue warrants. However, the City of Bryan reserves the right to sell the warrants and pay all in cash.

All lump sums and unit prices must be stated in both script and figures. The City of Bryan reserves the right to reject any, or all bids, or to accept any bid, and also to waive all formalities.

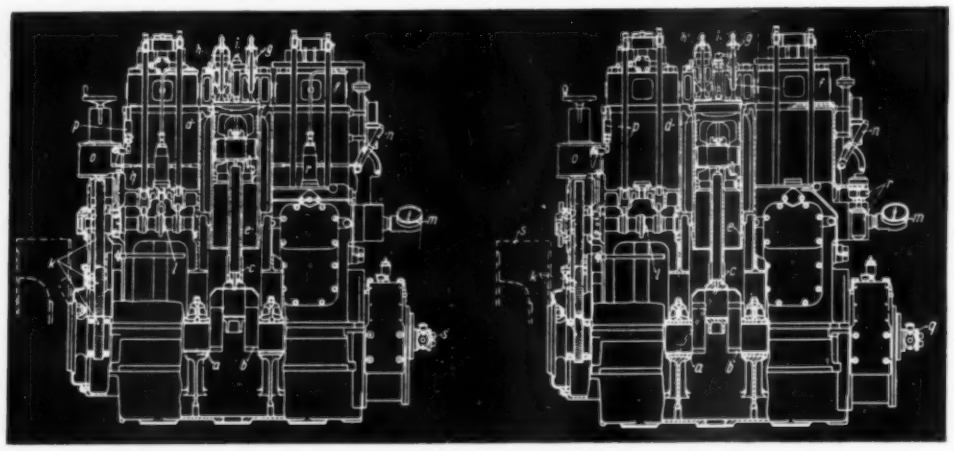
R. G. WILLIAMS, *City Manager*
October 26, 1938

POLY-FUEL DIESEL EN

By B. J. VON BONGART

DUAL fuel Diesel engines such as Diesel-oil and natural gas, or Diesel-oil and gasoline, are standard combinations and are in wide use.

Abroad, there seems to be a distinct tendency towards poly-fuel engines, i.e., engines that may be fed Diesel-oil, natural or coke-oven gas or carbureted fuel such as gasoline. If there were but one manufacturer offering such multi-fuel engines, one could regard the attempt as a misguided effort. But since there are more than a "baker's dozen" manufacturers offering such engines – and they are actually being sold in quantities – there must be a legitimate demand for poly-fuel engines.



UNIVERSAL TYPE OF DIESEL ENGINE

Left – Engine to operate as a full Diesel. Note small compression space at "d" also "filler block at 'c'" to increase length of the connecting rod thus reducing the compression space.

Right – The same engine to operate with carburetted gasoline. Note absence of filler blocks at "c" hence large compression space at "d".

These engines are essentially full Diesels with an average compression ratio of 18:1. For gas operation the compression ratio is 8:1 or 9:1, while for gasoline operation, the ratio is reduced to but 6:1. When such Diesel engines operate on gas with spark ignition, the power output drops from 5 to 15 per cent, depending upon the calorific value of the gas. The thermal efficiency depends, amongst other things, on the compression ratio of the engine, which, in the case of a gas engine, is definitely limited by the tendency of self-ignition. The natural, coke-oven or producer gas used for such engines consists essentially of methane, carbon monoxide and hydrogen. The higher the hydrogen content the more prone to auto-ignition is the gas; hence, a lower compression ratio is mandatory. With a compression ratio of 8:1, the thermal efficiency obtainable will be 29 per cent. If it were possible to secure a gas free from hydrogen, a compression ratio of 12:1 would be permissible, which in turn would increase the thermal efficiency to 32 per cent.

The methods used for converting a Diesel into a gas or gasoline engine differ greatly; with some makes of engines it really amounts to rebuilding. The following is a method used by one manufacturer:

1. Replacing the pistons, i.e., substituting pistons with lower heads to increase the compression space.
2. Fitting a mixing valve or carburetor, as the case may be.
3. Replacing the fuel injection nozzles by spark plugs.
4. Removing the fuel pump or setting the pump for zero delivery.
5. Removing fuel pump delivery piping.
6. Fitting an ignition distributor and coil and cables to the spark plugs.

This is a relatively simple method, and it is

EL ENGINES

said that this conversion can be accomplished by experienced mechanics within four to six hours.

As has been stated previously, the drop in horsepower may be from 5 to 15 per cent when a Diesel is converted into a gas engine. At least one European manufacturer saw fit to remove this handicap by providing an extra set of cylinder sleeves. As a Diesel, this manufacturer's engine is of 5½ in. bore and 8 in. stroke. When it is desired to operate with gaseous fuel, the standard cylinder liners (5½ in. bore) are removed and larger liners giving a 6 in. bore are substituted, so as to make up for the horsepower loss unavoidable with gas operation. While the recuperation of the full horsepower output is desirable, it is questionable whether in this case the net gain is worth the effort.

Some manufacturers, on the other hand, supply what has come to be known as "universal" engines. These are full Diesels, but the intake manifold is of the three-port type, i.e., free air intake for Diesel operation, mixing valve for gas and carburetor for gasoline operation. The fuel pump drive-dog may be disconnected when a change-over is made; the ignition device is, of course, permanently fixed to the engine. Here, removing the injection nozzles and substituting spark plugs, dismantling the fuel pipes and attaching the ignition cables constitutes the change-over, except for the lowering of the compression ratio. This is accomplished in a simple and unique manner. The engine (see illustration) is fitted with large hand holes, giving ready access to the crankcase and connecting rods. The latter, when the engine operates as a Diesel, are fitted with large filler-blocks, thus pushing the pistons up and decreasing the compression space. When it is desired to operate the engine with gas, smaller filler blocks are substituted which in turn increase the compression space. For gasoline operation, no filler blocks are fitted and thus the compression space is largest, hence giving the low 6:1 ratio.

This method obviates removing cylinder heads and pistons and thus saves effort and time. It is stated that with engines of this type a change-over can be made within but one to two hours, which accounts for the popularity these so-called "universal" engines enjoy.

NEEDLE ROLLER BEARINGS AND NEEDLE ROLLERS

THE Norma-Hoffmann Bearings Corporation has developed a series of Precision Needle Roller Bearings and Needle Rollers for wrist pin applications of internal combustion engines of the Diesel type, where motion is oscillating and the loads are heavy; moreover where space is limited and lubrication difficult. A wrist pin application is shown in Fig. 1. The Precision Needle Roller Bearing has demonstrated its ability to perform satisfactorily under these conditions and this type of bearings is now used for a wide number of applications such as: countershaft idler gear, cam roller, etc.

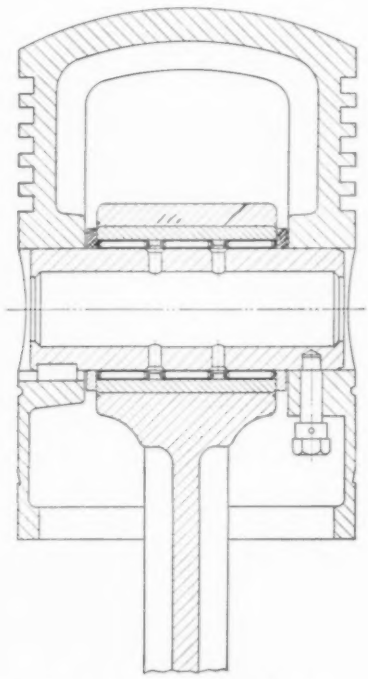


Fig. 1 Diesel engine wrist pin.

In general, Needle Rollers commend themselves for all applications where minimum weight, low friction, and highly concentrated load capacity are requisites.

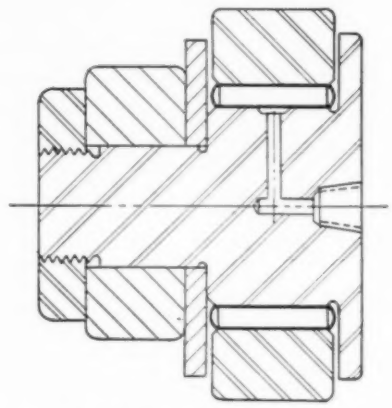
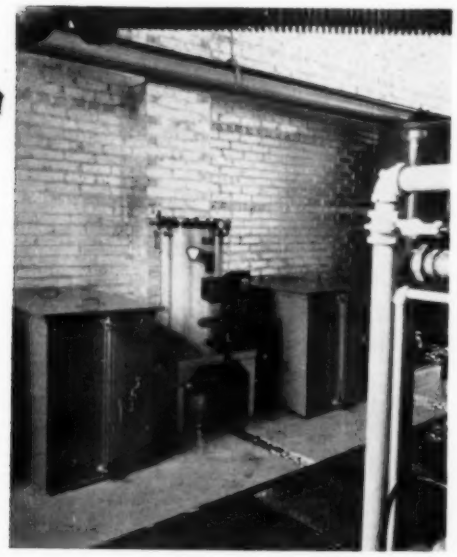


Fig. 2 Cam Roller, Needle Rollers support.

For cam roller services, Needle Rollers may readily be used. An anti-friction bearing surface – with free running cam rollers – of simple but adequate construction, is shown in Fig. 2.

SKINNER FILTER AT EATON RAPIDS, MICH.

As stated on page 39, a Skinner Super Filter is installed in the Tri-County Electric Co-operative installation at Eaton Rapids, Michigan. This mechanical filter floats on the line, efficiently and automatically maintaining the lube oil in excellent condition.



Skinner Super Filter installed at Eaton Rapids, Michigan

These Skinner Super Filter units are made up of many hundreds of very thin flexible discs, pressed closely together without spacers, which remove from the oil passing between these discs the injurious impurities, including all solid matter and both free and entrained moisture.

The filtering operation is fully automatic and extremely simple. The impurities are stopped at the edge of the filter packs and they are cleaned by merely blowing or reversing flow through the filter packs with compressed air. Units of proper size are available to take care of practically any size or type of Diesel installation. Further information may be obtained from the Skinner Purifiers, Inc., 2231 Dalzelle St., Detroit, Mich.

SEABOARD ORDERS BUDD TRAIN

PHILADELPHIA – Seaboard Railway has placed an order for a seven-car "day-light" type stainless steel train from Edward G. Budd Manufacturing Co. The train will consist of all-chair equipment and will be powered by a 2,000 hp. Diesel electric locomotive built by Electro-Motive Co.

DIESEL ENGINE COOLING

IF I may be pardoned for referring to history in an age when only prophecy is permitted, I should like to turn back the pages of the history of Diesel engine development covering the past 25 years and note some of the changes which have occurred in our conceptions regarding engine cooling.

A. P. Chalkley in his book "Diesel Engines for Land and Marine Work" (fourth edition 1914) comments on cooling water temperatures of that day as follows:

"The temperature of the cooling water as it leaves the jacket is best kept in the neighborhood of 120° F. in temperate climates, though it is perfectly safe to allow it to rise to as much as 180° F. for prolonged periods."

"The Diesel Engine" by Wells and Wallis-Tayler, published in 1915, indicates that from 2 to 4 gal. of cooling water per horsepower per hour was necessary with the temperature rise through the engine varying from 60° F. to 120° F. Outlet water temperatures as high as 158° F. were reported. Both books were published in England and reflect primarily European practice of that day.

Considering the experience of a prominent American Diesel engine builder in the matter of cooling water quantities and temperatures during this same quarter of a century, we find that in 1914 he recommended the use of 3 gallons of circulating water per horsepower per hour. This represents a temperature rise of approximately 100° F. through the engine with an outlet temperature of 180° F. This operating condition should be severe enough for anybody's engine! Two years later this same manufacturer was recommending from 8 to 10 gallons of circulating water flow per horsepower per hour. This represents a temperature rise of from 30° to 38° F. Today this same manufacturer would "look with suspicion" on cooling water operating conditions with his engines even approaching those of 1914 or 1916. He would insist on a double circuit or closed cooling system, water temperature off the engine of 140° F., a temperature rise of the cooling water passing through the engine not exceeding 15° F., and a water flow of from 20 to 30 gallons per horsepower per hour.

Three factors, all interrelated, influence the operation of the cooling water system of a Diesel engine. These factors are:

By GLENN C. BOYER

Associate Engineer of
Burns & McDonnell Engineering Co.

1. Kind and quantity of salts dissolved in the cooling water available.
2. Type of cooling system utilized (single- or double-circuit system).
3. Maximum water temperature off the engine.

If engine cooling is accomplished with a single-circuit system utilizing water having a relatively high mineral content, it is necessary to keep the temperature of the water leaving the engine low in order to prevent excessive scale formation in the engine jackets. On the other hand, with a double-circuit cooling system in which the water passing through the engine jackets is free of scale forming impurities, the temperature of the water leaving the engine can be raised to a higher value than that possible with a single-circuit system.

Since most waters available for cooling purposes in Diesel engines have considerable mineral salts dissolved in them, experience has taught that it is necessary with a single-circuit system to keep the jacket water temperatures low in order to keep the scale forming calcium and magnesium salts from depositing in the engine jackets and seriously interfering with the cooling process. For years the single-circuit cooling system was the only one used in Diesel plant operation to any extent, and as a result of the scale formation danger always present with the use of such a system, it became necessary to design engines which would operate with jacket water temperatures off the engine below 120° F.

The gradual increase in the use of the double-circuit cooling system for Diesel engines during the past several years with a soft or relatively scale free water being used for the jacket cooling side, has permitted the use of higher outlet water temperatures without the danger of scale fouling of engine jackets attended by stuck rings, scored cylinder walls, and severe hot spots. However, until the past year, the maximum temperature off the engine has been held by most manufacturers of engines to 140° F.

In presenting a paper on "Waste Heat Recovery from Diesel Engines" before a meeting of the Oil and Gas Power Division of the A.S.M.E. at Pennsylvania State College in August, 1937, I touched upon the question of circulating water temperatures as part of the consideration in studying waste heat problems. The discussion of my paper raised several questions as to

the advisability of holding outlet water temperatures from the engine as low as 140° F. when using a double-circuit system for cooling. It was pointed out in that discussion that outlet temperatures of 160° to 165° with a double-circuit cooling system would not be unreasonable. It was furthermore pointed out that an increase in the thermal efficiency of the engine might be expected by the utilization of higher outlet water temperatures.

Since this conference at Pennsylvania State College, a year ago, several engine installations have come to my attention which indicate that a double-circuit cooling system in which the temperature rise of the cooling water through the engine is limited to from 10° to 15°, and where the outlet temperature is maintained constant at from 150° to 160° has much to recommend it over cooling systems in use heretofore.

I recently examined a plant utilizing internal combustion engines burning sewage gas where the inlet water temperature was 125° and the outlet temperature was 165°. A discussion with the operating staff and the manufacturer of the engines about the advisability of a 40° temperature rise with an outlet temperature as high as 165° indicated that neither the operating personnel nor the mannufacturer considered such cooling water conditions particularly severe. In view of the experience of Diesel engine manufacturers during the past several years, however, it appears that the use of outlet water temperatures from the engine as high as 160° requires a relatively small rise in the temperature of the water through the engine jackets as well as a constant temperature of the water off the engine at all loads.

This trend toward higher outlet water temperatures is of decided importance to the Diesel plant operator. The higher outlet temperature means better engine economy in most instances, and where a cooling tower or spray pond supplies the cooling water, a smaller tower or pond for the same engine horsepower as compared to operation at lower outlet temperatures.

I previously referred to one of the desirable features of a cooling system as being a constant outlet temperature of the cooling water from the engine. How can such a condition be secured when the load on any engine in a power plant is continually changing, when the temperature rise through the engine as a consequence is fluctuating, and when, due to weather conditions, the temperature of the cooling water to the engine is varying in many instances from 40° to 90° F? The answer is the use of a temperature controlled valve bypassing water around the cooling tower in a single-circuit system or the heat exchanger in a double-circuit cooling system. By the use of such a valve controlled by the temperature of the discharged cooling water from the engine, a constant outlet water temperature can be maintained with a constant quantity of water passing through the engine.

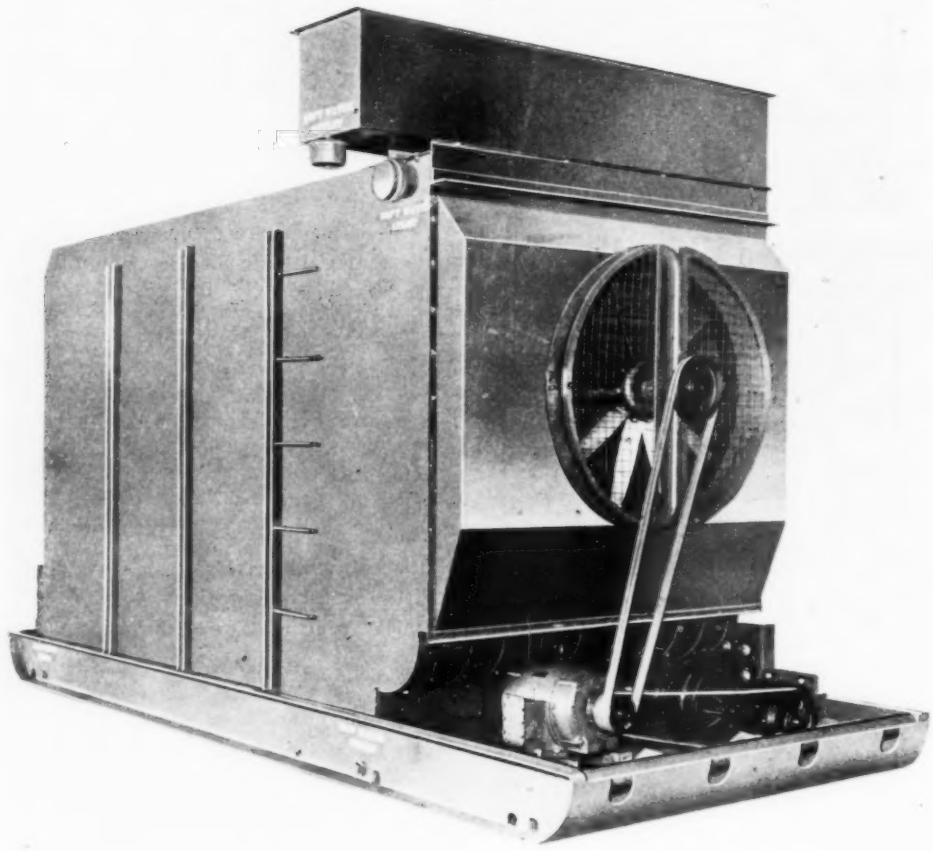
1939 NATIONAL MOTOR BOAT SHOW TO BE HELD JAN. 6 TO 14

NEW YORK, Dec. 1 – The 1939 National Motor Boat Show will be held here January 6 to 14, Henry R. Sutphen, president of the National Association of Engine and Boat Manufacturers, today announced. The annual exposition, to be staged at Grand Central Palace, will be the 34th that the Association has sponsored since 1905.

DIESEL PROGRESS

INDEX OF ADVERTISERS

PORTABLE WATER COOLING UNITS FOR OIL FIELD DIESELS



THE Marley Company has developed four standard sizes of portable water cooling units for use with oil field Diesel engines or, for that matter, any kind of internal combustion engines. These units combine a number of very desirable features: such as easy portability. One man on a truck with power winch can pick up, transport and unload it anywhere.

The closed system of copper atmospheric tube sections cools jacket water without ever exposing it to the outside air, thus saving all the valuable soft water for continuous recirculation, keeping it pure and preventing scale.

Efficient heat transfer. Fully tested and rated. Cooled soft water can be provided at the exact temperature for a particular engine's requirements, thus assuring highest efficiency.

Enclosed soft water prevents the internal scale which cracks engine heads. Controlled cooling supplies proper oil temperatures and eliminates cylinder strain. Simple hook-up avoids costly new arrangements and piping at each move.

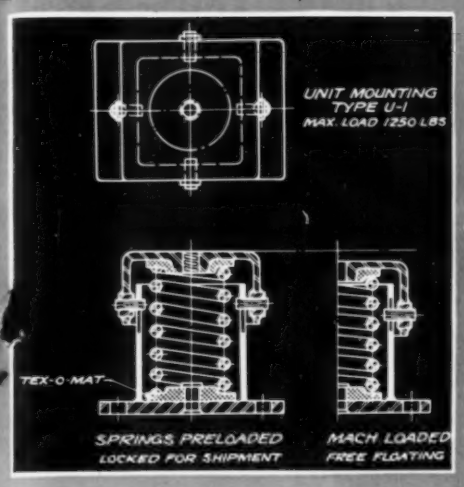
Sturdily built for heavy duty service. Staunch construction permits rough handling in transportation and severe use and exposure on the job without danger of damage.

The four standard sizes offer a correct model for every oil field requirement. Electric motor, either AC or DC, gas or gasoline engines, can be supplied for the power drive. These drives are interchangeable in case, in different localities, it becomes desirable to change the type of power used.

These units have been developed and built by the Marley Company, Fairfax and Marley Roads, Kansas City, Kansas, who will be glad to supply our readers with full information.

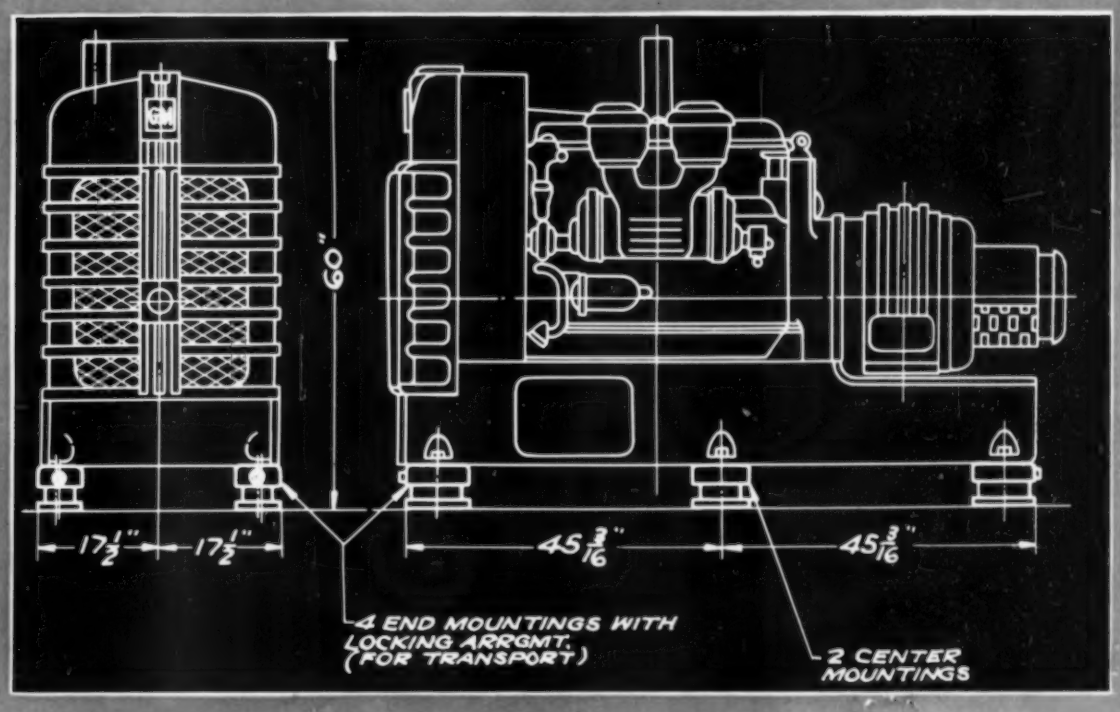
A SLIGHT ERROR

On page 56 of our November issue we reported the sale of a pair of 300 kw. Cooper Bessemer Diesel Engines to the New York and Honduras Rosario Company, large operators of silver mines in Honduras. We also stated that the electric equipment was being supplied by Westinghouse. This was an error—General Electric are supplying the generators, switchboards, etc. Sorry.



HUSSMAN SPRING MOUNTINGS FOR PACKAGED POWER UNITS

Carefully engineered for each unit, standardized in production and ready for immediate shipment.



A COMPLETE line of standardized Hussman Spring Mountings have been developed for the Series 71 General Motors Packaged Power Units, for the one, three, four and six cylinder models.

These Hussman Spring Mountings have been properly designed and correctly applied. The springs are designed for the lowest frequencies of the forced engine vibrations, with frequency ratios sufficiently high for maximum efficiency. The application is such that they are allowed full freedom to develop their elastic properties in all directions, without interference, without blocking, without lateral constraint, resulting in isolating efficiencies approaching 100%.

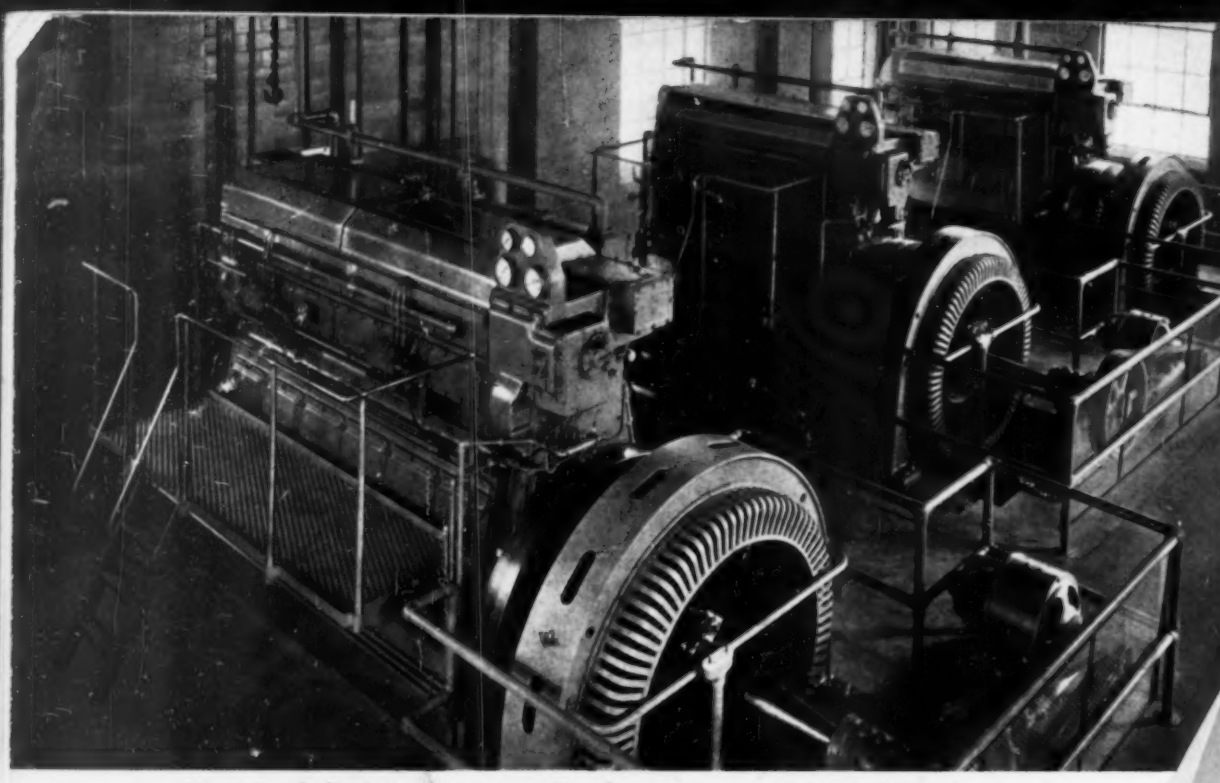
The absence of cork, felt, rubber or any other material of the organic class, renders Hussman Spring Mountings immune against water, oil or other influences. Welded steel construction is used throughout, insuring great durability, and maximum strength, combined with minimum weight. Simple to instal, as NO adjustments are necessary in the field.

Sold with the specific Guarantee, of your complete satisfaction.

CARL HUSSMAN

Specialist in solving vibration problems

120 South La Salle St., Chicago, Ill.



Municipal light plant at Ogden, Iowa, containing three Cooper-Bessemer Type GN Diesel engines.

$5,000 Profit *with* C-B Diesels!

A news clipping from the "Ogden Reporter" explains why that city's chairman of the Light Board writes, "We are indeed proud of our Diesel plant . . . with a constantly increasing load, we expect to make an even better report next year!"

Ogden, with a population of 1500, shows its citizens profits from Cooper-Bessemer Diesels right from the start! That's exactly what you want your Diesels to do . . . whether you are municipal engineer, private plant owner, or operator.

Our representative will gladly tell you more about profit-making Cooper-Bessemer Diesels for *your* power purpose.

Light Plant Is Profitable During First Year

Make Payments On Bonds On Time — Have Good Balance

Ogden's municipal light and power plant shows a net proft of $5,019.97 for the frst year's operation after paying all running expenses in addition of $5,000 payment on bonds and some $2,400 in interest payments. The condensed statement below will give the taxpayers some idea as to the volume of business transacted and the amounts spent in the various departments as well as the profits which have accrued during this past year:

Receipts

Total collected for 1 yr.	$21,578.04
Other receipts	273.59
Total receipts	$21,851.63

Disbursements

Paid salaries	$ 3,890.00
Paid fuel oil and lubricating oil	3,558.25
Sales tax remitted	370.55
Labor and supplies	1,542.86
Paid interest on indebtedness	2,470.00
Paid on principal of indebtedness	5,000.00
Total Disbursements	$16,831.66
Balance on hand at close of year July 31, 1938	$ 5,019.97

Respectfully submitted by
The Mayor and Town Council

THE COOPER-BESSEMER CORPORATION

Mt. Vernon, Ohio — PLANTS — Grove City, Pennsylvania

25 West 43rd Street, New York City
Mills Building, Washington, D. C.
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